

Appendix C – ESA Consultation Biological Assessment



REVISED BIOLOGICAL ASSESSMENT

For the

**Volta Wildlife Area Level 2 Diversification/
Incremental Level 4 Development Pilot Project**

Project Location

**VOLTA WILDLIFE AREA, MERCED COUNTY,
CALIFORNIA**

USGS 7.5 minute Quadrangles: Ingomar and Volta, CA

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1 INTRODUCTION

The purpose of this document is to review the proposed action in sufficient detail to determine the effect on any of the threatened, endangered, proposed, or sensitive species and designated or proposed critical habitats listed below. In addition, the following information is provided to comply with statutory requirements to use the best scientific and commercial information available when assessing the risks posed to listed and/or proposed species and designated and/or proposed critical habitat by proposed federal actions. This document is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C 1536(c)).

The following listed species *may be affected, is likely to be adversely affected* by the proposed action and is further addressed in this document:

- Giant Garter Snake (*Thamnophis gigas*) – Threatened

1.1 Background

Pursuant to the Central Valley Project Improvement Act of 1992 (CVPIA), Section 3406(d), the Secretary of the Interior, through the Bureau of Reclamation (Reclamation), is obligated to provide firm water supplies of suitable quality to 19 specific wetlands and wildlife habitat areas (refuges) within the Central Valley, including the Volta Wildlife Area (WA) and the Grassland Resource Conservation District (GRCD).

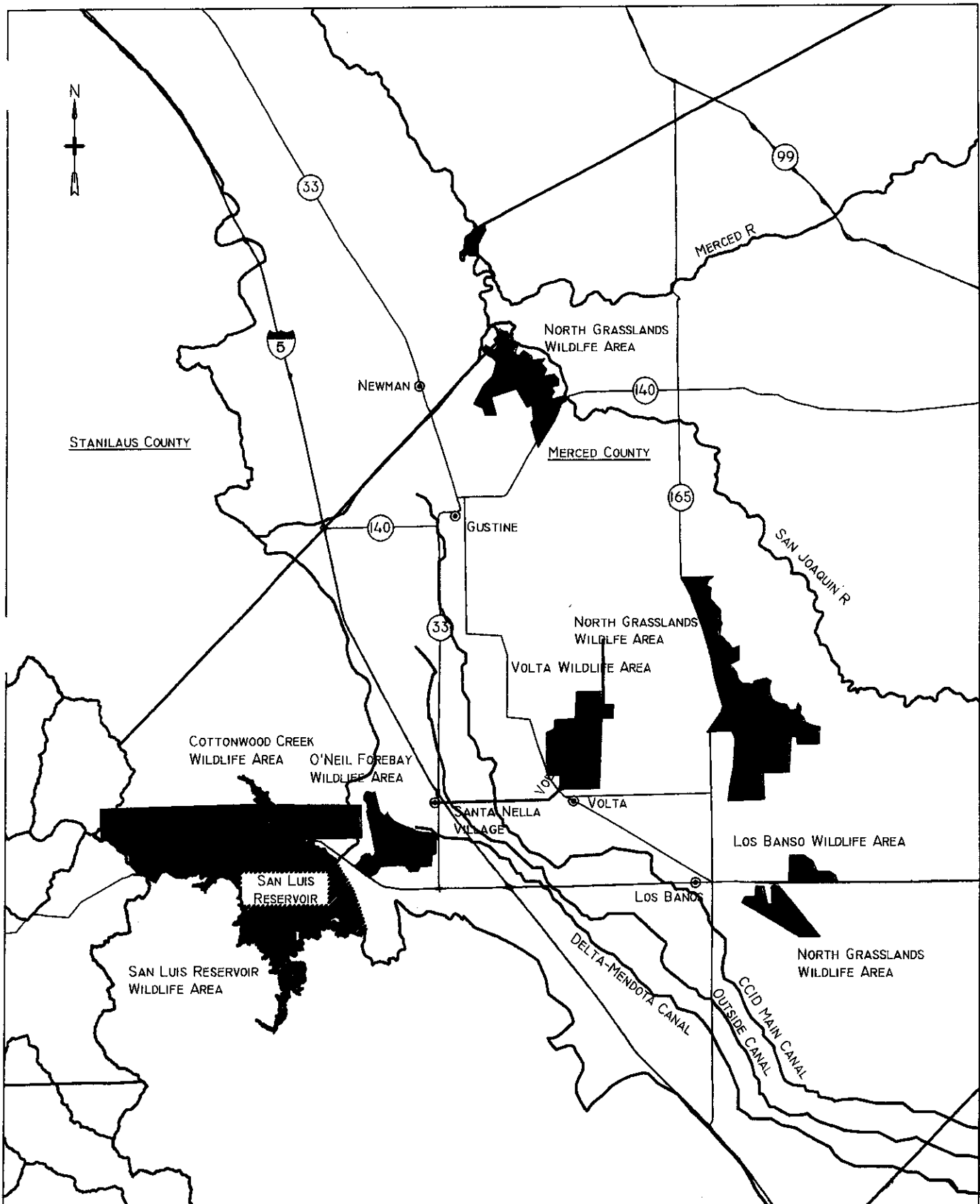
Annual refuge water allocations were established in the *Report on Refuge Water Supply Investigations (3/1989)* and the *San Joaquin Basin Action Plan/Kesterson Mitigation Plan (12/1989)*, both reports incorporated into CVPIA by reference. Allocations are distinguished for two water types: Level 2 and Level 4. Level 2 Refuge Water Supplies refer to the historical annual average amount of water these refuges received between 1977 and 1984. Level 4 Refuge Water Supply is the annual amount of water needed for full development of the refuges based upon management goals developed in the 1980s. Incremental Level 4 is the difference between historic annual average water deliveries (Level 2) to refuges, and the refuge water supplies required to achieve optimum wetlands and wildlife habitat management (Level 4).


Section 3406(d)(2) requires that Reclamation provide full Level 4 supplies to all refuges starting in 2002. However, due to constraining issues including availability of water for Incremental Level 4 acquisition, funding and inadequate external conveyance capacity, Reclamation has not yet been able to meet that goal.

Approximately 3,000 acres of wetlands and waterfowl habitat at the Volta Wildlife Area (WA) require flooding to start mid-summer to provide feeding and resting areas for early arriving waterfowl in the fall. Volta WA is the first, and often only, area flooded in the GRCD this early in the year. The estimated annual Level 4 water requirement for Volta WA is 16,000 AF. Diversifying the uses of available CVP water and providing an additional dependable supply of water for Volta WA are the primary goals of this project. Reclamation is obligated to provide up to 13,000 AF of Level 2 water to the Volta WA pursuant to its management agreement with CDFG. An additional 3,000 AF is recommended for Incremental Level 4 supplies for a total of 16,000 AF.

1.2 Project Location

Volta WA is located approximately six miles northwest of Los Banos in western Merced County, as shown in Figure 1. Volta WA is owned by Reclamation and has been operated by California Department of Fish and Game (CDFG) since 1952 under a lease agreement. The refuge lies within the GRCD, along its southwest boundary. The Wasteway is the primary supply canal for the Northern Division of the GRCD. The Wasteway enters the Volta WA at the southwest corner and passes through the center. The water is lifted into two ditches by low lift pumps near Ingomar Grade Road. The ditches convey water to the eastern and western sections of the Volta WA. Water flows from the boundary ditches to internal ditches by gravity. The ditch along the southern boundary contains runoff from an adjacent dairy. Water is also diverted from the Wasteway via outtake pipes located near a check dam in the center of the Volta WA.



 FRANSON CIVIL ENGINEERS	DATE: AUGUST 11, 2009	VOLTA WASTEWAY LEVEL 2 DIVERSIFICATION PROJECT	FIGURE I PROJECT LOCATION
	SCALE: 1" = 600'		
	Figures.dwg H:\CLIENTS-USBR Area\1- 2006 IDIQ Contract\5- Projects\Volta\1-PROJECT\4 Drawings		
	LAYOUT: SHP		

2 DESCRIPTION OF PROPOSED ACTION

2.1 Project Objective

The objective of the proposed three-year pilot project is to develop a groundwater supply in the Volta WA that can be used to diversify Level 2 Refuge Water Supply sources and supplement the source of Incremental Level 4 Water Supply, improve water supply reliability for CVP contractors, and to confirm that the water quality is suitable for refuge use. Reclamation's objective is to produce up to 2,000 AF of groundwater per year from this program. The analysis of water quality would occur through the implementation of a groundwater monitoring program. The pilot project water would be supplied to Central Valley refuges that are entitled to receive CVP water pursuant to Section 3406(d) of the CVPIA and can receive the water by direct delivery from the Wasteway.

2.2 Proposed Action

In response to the ongoing drought and the Secretary of the Interior's responsibility to provide firm water supplies to the refuges, Reclamation proposes to provide American Recovery and Reinvestment Act (ARRA) funding for the installation of two groundwater production wells and two monitoring well clusters along the Volta Wasteway for a three year pilot project. The proposed well sites are located within the boundaries of the Volta WA. The purpose of the Proposed Action is to diversify a portion of the existing Level 2 water supplies delivered to the Volta WA and GRCD which would result in a like amount of CVP surface water made available for CVP agricultural contractors, while specific refuge water supply needs/obligations are satisfied. The Proposed Action will also provide for development of additional Incremental Level 4 water supplies which will augment the limited pool of Incremental Level 4 water available to those refuges south of the Delta. This Pilot Project would plan for, design, and construct the needed facilities (June 2010 start), and then operate the wells and monitor well production, water quality, and water levels during the three-year period (September 2010 to February 2013). The Pilot Project would implement monitoring at the two locations to confirm that water quality is suitable for refuge use. Based on the data acquired a determination would be made to continue or cease the diversification operations at any time during the Pilot Project.

New pilot wells at Volta WA would pump groundwater (anticipated production is up to 2,000 acre-feet [AF]) five months/year beginning in September/October through January/February of suitable quality that can be conveyed and used within Volta WA and GRCD. In order to provide flexibility, the duration and volume of groundwater pumped annually under the proposed action may increase to year round pumping of up to 5,000 AF. An increase would only occur if, after the first year of production at the 2,000 AF level, the monitoring data shows suitable water quality and water levels which would sustain additional pumping. Additionally, a sufficient surface water flow must be available in the Wasteway for dilution if it is necessary.

As stated previously, the groundwater would be utilized in the Volta WA and GRCD. The total amount of groundwater pumped annually would be split 50/50 between Level 2 and Level 4 water supply in order to address CVPIA Section 3406(d)(1) diversification goal. The groundwater would be substituted in lieu of south of Delta Refuges receiving a portion their CVP Level 2 surface water supply. The accepted ratio is two AF groundwater to one AF surface water.

It is anticipated that the use of groundwater could free up to 2,500 AF of CVP Level 2 surface water supply annually. The Level 2 water freed up by groundwater substitution would be delivered to the SLDMWA. SLDMWA contractors would utilize the CVP surface water supply within their service areas for reasonable and beneficial use. The Pilot Project would diversify refuge water supply, improve water supply reliability and minimize adverse impacts to CVP agricultural and municipal contractors.

Well-related construction activities which would occur as part of the Proposed Action include:

- Drill pilot borings to obtain information for the final design of the production and monitoring wells,
- Final design of the two production wells and five associated monitoring wells,
- Drill production wells and monitoring wells and place associated pipelines from wells to the Wasteway,
- Well testing to estimate the sustainable yield of the production wells, and
- Design and installation of the pump based on well testing results,
- Construction of the surface facilities (e.g., fences around wells), and
- Implementation of a three-year monitoring program

Well Design Approach

Well design would be in accordance with the American Water Works Association standards and the California Department of Water Resources for Well Standards, Bulletin 74-90 dated June 1991. A total target range of up to 2,000 AF/year is the anticipated production rate for pumping occurring between September/October through January/February. However, the actual yield may be more or less depending on aquifer conditions and changes to pumping durations.

Test-Production Well Construction

Reclamation plans to construct two- production wells. The construction window for the production wells is between May 1, 2010 and October 1, 2010. The entire construction window would not be necessary to erect the wells. It is anticipated that if construction begins in May 1, 2010, the production wells would be completed prior to June 2010. The production wells would produce groundwater from geologic units at depths ranging from approximately 500 to 900 feet below ground surface (bgs).

Well Locations

The two selected production well sites are located along the federal right-of-way abutting the Volta Wasteway at a distance of approximately 2,000 feet apart. Well Site #1 is located just north of and adjacent to the Volta Wasteway and Well Site #2 is located on the south side adjacent to the Volta Wasteway as shown on the aerial map in Figure 2. Figure 3 is a closer aerial view of the VWA and the well locations. The approximate GPS coordinates of the two wells, +/- 25 feet, are:

- Well Site #1: 37° 06' 22.147" latitude and 120° 56' 10.001" longitude, and
- Well Site #2: 37° 06' 26.986" latitude and 120° 55' 52.897" longitude.

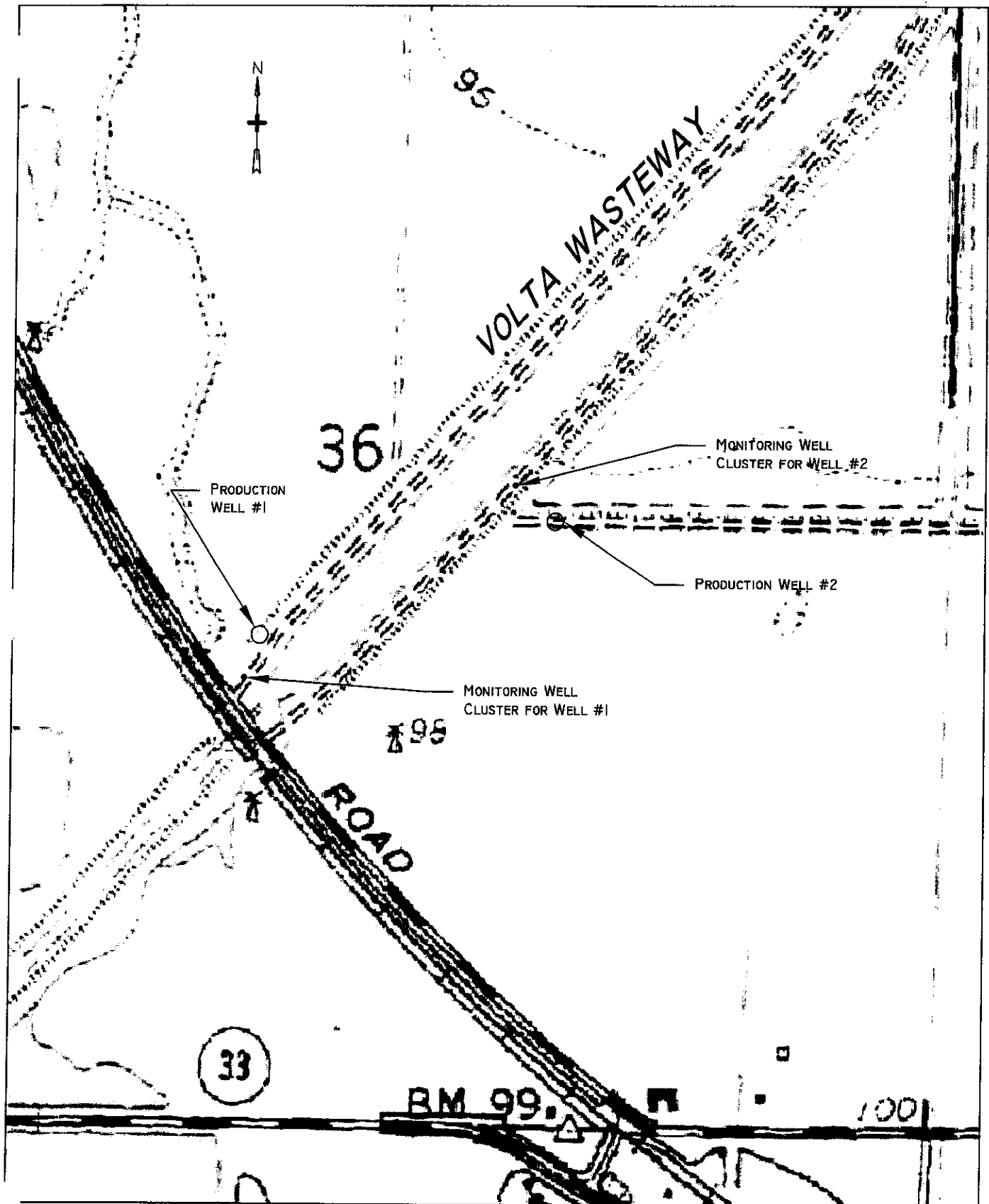
Access to the well sites would be by existing roads with short access road needed for Well Site #1. This short access road would be surfaced with gravel. A 30- to 40-foot gravel pad around each production well site would be necessary for routine operation and maintenance activities. A 150-foot x 150-foot work area would be needed for actual drilling. Staging, drilling and installation are estimated to require three weeks on site (15 days @ 10 hours/day) for each production well.

The production wells would be drilled using a large truck-mounted reverse circulation mud rotary drilling rig equipped with a mud pump, pipe rack, and drilling fluid holding tank/shaker system. Steel casing would be used for the two production wells. Concrete pads would be constructed and the production wellheads would be configured to accommodate electrical service to the wellhead as well as the discharge piping.

The pumps may range from 8 to 12 inches in diameter. The pump may be a submersible or a vertical turbine. The pump size and type would be determined after well testing has occurred and aquifer conditions are known.

Construction discharge piping is necessary for the conveyance of groundwater from the wellhead to the Wasteway. Well #1 requires 100 feet of 12 inch PVC pipe and a trench 3 feet deep to the edge of the Wasteway. Well #2 requires 300 feet of 12 inch PVC pipe laid in a trench 3 feet deep at the minimum and 12 feet deep at the maximum. The areas would be trenched using a backhoe, restored after pipe is laid and recovered with trenched material. In addition, groundwater would be discharged in a manner to prevent bank disturbance. In order to dissipate the energy of the discharged water to a point that would not cause erosion, either a concrete discharge structure or a stainless steel structure would be utilized in conjunction with bank protection. The specifics for each well are:

- Well #1 and Well #2: The discharge pipeline would run perpendicular to the Wasteway from the wellhead. An underground pipe would convey the pumped groundwater to a concrete structure constructed on the Wasteway bank. The concrete or stainless steel structure would dissipate the energy to prevent erosion of the bank.



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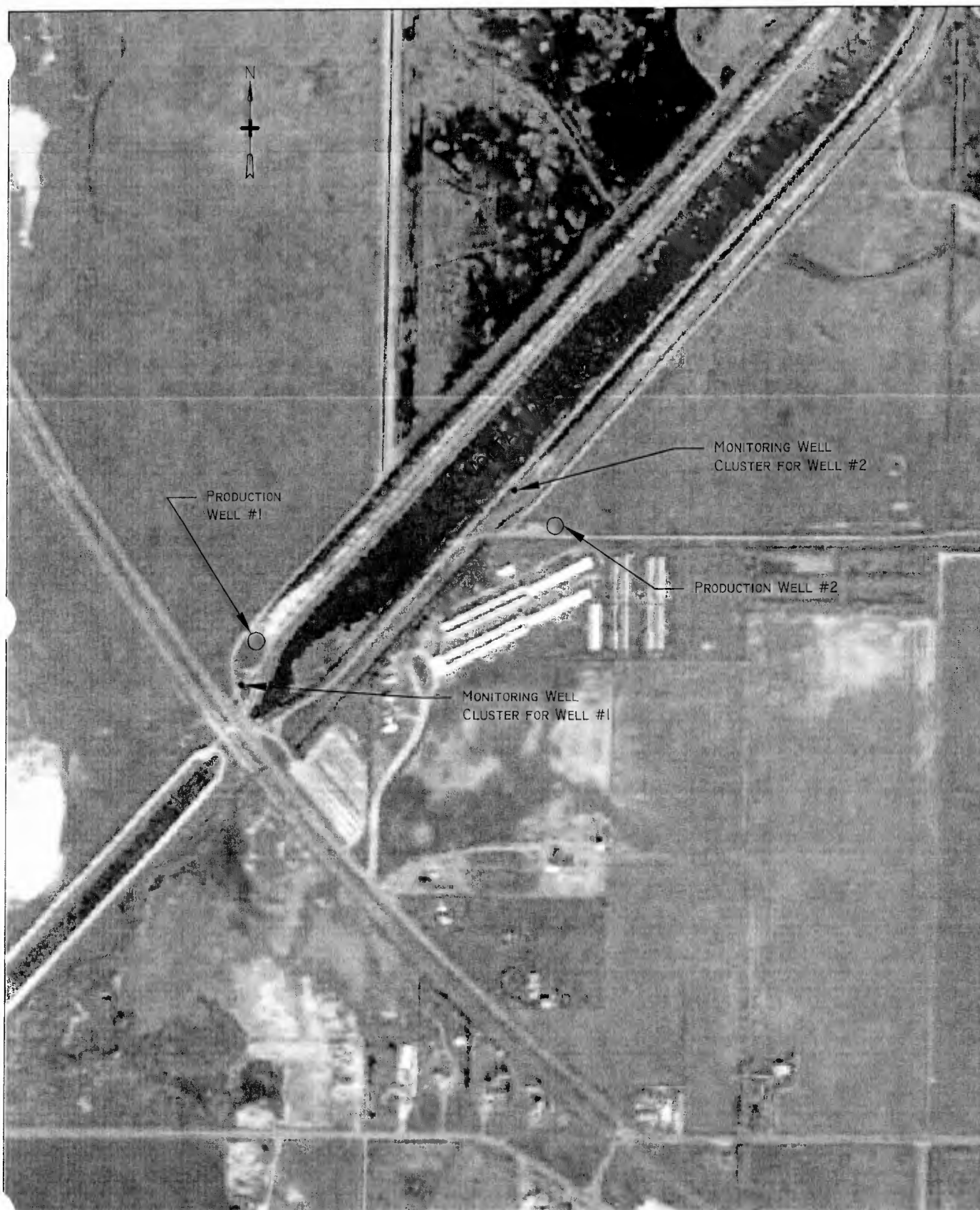
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LAYOUT: Quad

VOLTA WASTEWAY LEVEL 2 DIVERSIFICATION PROJECT

FIGURE 2
TOPOGRAPHIC MAP
OF WELL SITES



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CIVIL ENGINEERS

DATE: AUGUST 12, 2009

SCALE: 1" = 600'

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Projects\Volta\1-PROJECT\1.4 Drawings

LAYOUT: Aerial

VOLTA WASTEWAY
LEVEL 2 DIVERSIFICATION PROJECT

FIGURE 3
AERIAL PHOTO
OF WELL SITES

The width of the concrete or stainless steel structures outlet would depend on the well's yield. Once this is known, calculations would be made so that the discharge rate has a maximum velocity less than 3 feet per second.

The pilot boring would be drilled with a direct circulation mud rotary drill rig. In addition to the drill rig, the standard support equipment includes a drill stem trailer, compressor, and shaker unit to control the drill cuttings. A backhoe would likely be used to transport the drill cuttings from the production well site to a location to be determined in consultation with Reclamation and CDFG. During well construction, a larger reverse circulation drill rig would be used. In addition to the support equipment noted above, a transfer truck would be used to haul the gravel pack material to the well sites. The backhoe would also be used to dig a mud pit at each well site. The five monitoring wells would be installed with the direct circulation mud rotary drill rig to minimize land disturbance and costs.

The surface completions for each test-production well would consist of an 8-foot by 10-foot concrete pad and 20-inch discharge pipe. The wells would be located adjacent to the Wasteway. The discharge pipes of the wells would be routed from the well sites to the Wasteway and discharge would be at the edge of the Wasteway. A production well construction diagram is shown in Figure 4. Drilling of test holes for monitoring wells and construction of production wells is scheduled to begin in May 2010 and be completed by June 2010.

Monitoring Wells

A well cluster with a pair of monitoring wells would be drilled near each production well site to monitor water levels during the aquifer tests as well as throughout the three-year pilot project. The monitoring well clusters would include a well screened above the Corcoran Clay and one screened below the Corcoran Clay. A third monitoring well would be installed in association with Well #1 to monitor water levels within 100-feet of the surface. The purpose of the deep monitoring wells would initially be to assist in estimating aquifer hydraulic parameters during the aquifer tests, and later to assist in evaluating the sustainable pumping rates of the production wells and to assess the degree of well interference. The purpose of the shallow wells is to document the degree of communication, if any, between the deep production wells and the shallow aquifer during pumping. PVC casing would be used for the monitoring wells. Concrete pads and locking steel monuments would be installed around the monitoring wells.

The approximate GPS coordinates of the monitoring well clusters are:

- Well #1: 37° 06' 20.221" Latitude, 120° 26' 10.8333" Longitude
- Well #2: 37 06' 28.521" Latitude, 120 55' 52.855" Longitude

Additional support vehicles including a water tender, front-end loader, pipe truck, and pickup trucks would be parked on-site. The drilling rig and associated equipment would occupy an area of approximately 150 feet by 150 feet. Access for these vehicles would be directly off the adjacent existing road for the Well #1 monitoring wells. No

improvements for site access would be required for Well #1 monitoring wells. A 300 foot long access road would be constructed to allow access to the Well #2 Monitoring Wells. This access road would be of similar construction as other existing roads in the VWA. No off-site discharge of drill cuttings or fluids would occur. Drill cuttings and inert bentonite clay, produced during drilling operations, would be contained in an on-site settling pond and spread on site in an approved location upon well completion

During the development phase, the water would initially be very turbid. The production wells would be sampled for the presence of selected constituents (e.g., Boron, Arsenic, Selenium) following well development and prior to performing the aquifer tests. The water quality results may factor into the management decision for the large volume of water to be discharged during the aquifer tests.

Following the completion of the aquifer tests and the estimation of the aquifer hydraulic parameters, well efficiency, and assessment of potential well interference, a recommendation would be made for the initial pumping rates. Based on water level measurements recorded during implementation of the groundwater monitoring plan, we would re-evaluate the originally selected pumping rates and revise original recommendations, if necessary, based on the monitored performance of the well.

The production wells would pump 24 hours a day for four to five months beginning in September/October through January/February. Reclamation may decide to pump an additional volume of groundwater annually based on well efficiency, well productivity, and monitoring program data collected the first year of the pilot project. The additional pumping would occur outside of the five month period. Any increases in the production volume and pumping window would be contingent upon water quality data and water level data gathered during the first year of production (at the up to 2,000 AF level). The data must show extended pumping and volumetric increases are feasible and would not result in significant impacts to any resources identified in this environmental assessment. In addition, sufficient surface water flow for dilution must be available in the Wasteway. The volume of water pumped from the production wells is dependent on the duration of pumping. Based on a value engineering report, the two production wells would produce up to 2,000 AF of groundwater/year if only operated for four to five months. If the wells are operated outside of September/October through January/February the production wells could produce up to 5,000 AF of groundwater.

2.3 Restrictions/Avoidance Areas

During placement of the wells, best management practices would be followed to ensure that this project is completed with minimal environmental impacts:

- 1 Disturbance of vegetation shall be kept to a minimum.
2. No debris, soil, etc., other than that already present within the well shall be allowed to enter the water.
3. No equipment shall be operated in stream channels.

4. No intentional harassment, killing, or collection of plants or animals at or around the work sites.
5. No firearms are allowed on site, except for those used by peace officers or CDFG wardens.
6. No pets allowed.
7. All persons must stay within the boundaries of the work sites, which consist of the top of the levees, walkways, public and private roadways and waters, and water-side levee slopes.
8. No off-road travel or work is permitted; all vehicles must be confined to existing levee roads.
9. All trash, including food-related trash and cigarette butts, must be properly disposed of and removed.
10. Storage of hazardous materials, such as fuel, oil, etc. shall not be allowed within 150 feet of waterways. Any chemical spills must be cleaned up immediately and reported as soon as possible.

Work would occur within the disturbed upland areas adjacent to the Wasteway. Some work would also occur on the banks of the Wasteway for placement of the discharge control structures to alleviate erosion in the Wasteway.

2.4 Permits

The following environmental regulatory requirements would be obtained for implementation of the proposed action:

- Federal Endangered Species Act – This Biological Assessment documents that the Pilot Project may adversely affect listed species (GGS).
- State Historic Preservation Office – Section 106 consultation required for disturbance to area for well drilling

3 CONSULTATION TO DATE

A site visit with U.S. Fish and Wildlife Service biologist, Maryann Owens, and the California Department of Fish and Game Volta WA Manager, Bill Cook, was conducted on August 13, 2009. During this site visit, the proposed well locations on either side of the Wasteway and Pond 10 of the Volta WA were observed.

4 SPECIES ACCOUNTS AND STATUS OF SPECIES IN THE ACTION AREA

A species list was requested from the U.S. Fish and Wildlife Service (USFWS) on October 26, 2009 and is included in Appendix A. Table 1 below identifies those species that potentially occur in or may be affected by projects in the Ingomar and Volta USGS 7.5-minute quadrangle sheets.

Table 1: Species Identified as Potentially Occurring in the Ingomar and Volta USGS 7.5-minute Quadrangles

Common Name	Scientific Name	Federal Status ¹	Habitat in Area
INVERTEBRATES			
<i>Branchinecta longiantenna</i>	Longhorn fairy shrimp	E	No; vernal pools absent in area
<i>Branchinecta lynchi</i>	Vernal pool fairy shrimp	T	No; vernal pools absent in area
<i>Desmocerus californicus dimorphus</i>	Valley elderberry longhorn beetle	T	No; no elderberry shrubs present
<i>Lepidurus packardii</i>	Vernal pool tadpole shrimp	E	No; vernal pools absent in area
FISH			
<i>Hypomesus transpacificus</i>	Delta smelt	T	No; outside range
<i>Oncorhynchus mykiss</i>	Central Valley steelhead ²	T	No; outside range
AMPHIBIANS			
<i>Ambystoma californiense</i>	California tiger salamander, central population	T	No; outside range
<i>Rana aurora draytonii</i>	California red-legged frog	T	No; outside range
REPTILES			
<i>Gambelia (=Crotaphytus) sila</i>	Blunt-nosed leopard lizard	E	No; outside range
<i>Thamnophis gigas</i>	Giant garter snake	T	Yes
MAMMALS			
<i>Dipodomys nitratoideis exilis</i>	Fresno kangaroo rat	E	No; limited to the Alkali Sink and the Kerman Ecological Reserves, both in Fresno County
<i>Vulpes macrotis mutica</i>	San Joaquin kit fox	E	No; upland habitat limited in WA

¹ E=Endangered, T=Threatened

² Listed under the jurisdiction of National Oceanic and Atmospheric Administration, Fisheries

4.1 Giant Garter Snake

Current Status

According to the USFWS Draft Recovery Plan for the Giant Garter Snake (1999), GGS inhabits wetland habitats within the Central Valley of California. Loss and fragmentation of wetland habitats have extirpated the GGS from the majority of its historic range. The USFWS listed GGS as threatened on October 20, 1993 (Federal Register 58:54053). No critical habitat has been designated for GGS.

Habitat Requirements and Limiting Factors

GGS inhabits agricultural wetlands and other waterways such as irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands in the Central Valley. Essential habitat components consist of: (1) adequate water during the snake's active season (early spring through mid-fall) to provide adequate permanent water to maintain dense populations of food organisms; (2) emergent, herbaceous wetland vegetation, such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.), for escape cover and foraging habitat during the active season; (3) upland habitat with grassy banks and openings in waterside vegetation for basking; and (4) higher elevation upland habitats for cover and refuge from flood waters during the snake's inactive season in the winter (G. Hansen 1980, G. Hansen 1988, Brode and Hansen 1992, Hansen and Brode 1993 *referenced in* U.S. Fish and Wildlife Service 1999).

GGS bask in bulrush, cattails, shrubs overhanging the water, patches of waterweed (*Ludwigia peploides*) and other floating vegetation, and on grassy banks. In the San Joaquin Valley, GGS have also been observed basking in saltbush (*Atriplex* spp.) (Van Denburgh and Slevin 1918, Brode 1988 *referenced in* U.S. Fish and Wildlife Service 1999). Riparian vegetation such as saltbush and willows (*Salix* spp.) provide cover from predation. GGS also bask in openings in vegetation, created by riprap placed around water control structures. GGS use small mammal burrows, typically with sunny exposures along south and west facing slopes, and other soil crevices above prevailing flood elevations during winter (November to mid-March) (G. Hansen 1993 *referenced in* U.S. Fish and Wildlife Service 1999). Small mammal burrows, crayfish burrows, and soil crevices provide retreats from extreme heat for GGS during the active season (Hansen and Brode 1993 *referenced in* U.S. Fish and Wildlife Service 1999). Wintering sites varied from canal banks and marsh locations, to riprap along a railroad grade near the marsh (Wylie et al. 1997 *referenced in* U.S. Fish and Wildlife Service 1999). Wintering locations of radio-telemetered snakes tended to be in the vicinity of spring capture sites. GGS use burrows in the summer as much as 50 meters (164 feet) away from the marsh edge, whereas, overwintering snakes use burrows as far as 250 meters (820 feet) from the edge of marsh habitat (Wylie et al. 1997 *referenced in* U.S. Fish and Wildlife Service 1999).

The width of uplands used by GGS varies considerably. Many summer basking and refuge areas used by GGS are immediately adjacent to canals and other aquatic habitats and may even be located in the upper canal banks. USFWS has considered 200 feet as the width of upland vegetation providing habitat along the borders of aquatic habitat for GGS (USFWS 2006 *referenced in* Reclamation 2009). GGS also seek refuge in upland burrows during hot summer weather and have been documented up to 164 feet from aquatic habitat during this time. In a dynamic habitat, GGS frequently move in response to changing conditions in their rice, marsh, canal and ditch habitats, especially during the dry summer months. Connectivity between GGS home range size has been estimated from multiple studies conducted at Colusa NWR, and movement patterns have been described from studies within the Natomas and Colusa Basins. Home range size at Colusa NWR was reported to be as large as 2,792 acres in 1997 (Wylie et al. 1997 *referenced in* Reclamation 2009) and 427 acres in 2001 (Wylie et al. 2002 *referenced in* Reclamation 2009). The Draft Recovery Plan for Giant Garter Snake reports home range sizes as large as 642 acres at Gilsizer Slough and 202 acres at Badger Creek (USFWS 1999). Home range size is likely inversely correlated with habitat quality; such that smaller home range sizes occur in areas with the highest quality habitat. Recent work by Wylie and Hansen suggest that as long as conditions are optimal, snakes will stay close to where they over-winter and larger home range sizes are typically in response to adverse conditions.

GGS can move relatively long distances. Wylie et al. 1997 documented snakes moving up to 4.8 miles over a few days in response to de-watering at Colusa NWR. In the Natomas Basin, snakes routinely moved over a half mile and distances of over a mile were recorded on more than one occasion (Wylie and Casazza 2000 *referenced in* Reclamation 2009). A Colusa Basin study recorded the longest average movement distances of 0.62 miles, with the longest being 1.7 miles, for sixteen snakes in 2006, and an average of 0.32 miles, with the longest being 0.6 miles, for eight snakes in 2007 (Wylie and Amarello 2008 *referenced in* Reclamation 2009).

Because of the direct loss of natural habitat, the GGS relies heavily on rice fields in the Sacramento Valley, but also uses managed marsh areas in Federal National Wildlife Refuges and State Wildlife Areas. There have been only a few recent sightings of GGS in the San Joaquin Valley. Habitat loss and fragmentation, flood control activities, changes in agricultural and land management practices, predation from introduced species, parasites, water pollution, and continuing threats are the main causes for the decline of this species.

It has been suggested that selenium contamination and impaired water quality may be contributing factors in the decline of GGS (USFWS 1993 and USFWS 1999 *as referenced in* Hansen 2007). However, reptile toxicology information is lacking and no studies have been conducted that specifically examine toxicology in GGS (Hansen 2007). Research on species occupying a similar ecological niche as GGS (eastern water snakes) shows that bioaccumulation of trace elements, pesticides and other contaminants does occur in snakes and can result in adverse biological effects (Hansen 2007). While the effects of contaminants such as selenium on reptiles is not fully understood, toxicity thresholds are anticipated to be similar for reptiles, fish and birds, particularly for GGS

which feeds exclusively on aquatic prey (USFWS 1993 and USFWS 1999 *as referenced in Hansen 2007*).

Status of Giant Garter Snake in Action Area

In 1998, 1999 and 2000, surveys for GGS at Volta WA resulted in the capture of 11 snakes in Pond 26 and the Wasteway (northeast of Pond 26) (Sparks 2000). In 2001, surveys were unable to locate Volta WA populations previously found (Dickert 2001). In 2003, 31 GGS were captured at Volta WA and based on these numbers, CDFG estimated Volta WA's Wasteway population at 45 snakes (Dickert 2003). During this same time, juvenile GGS were captured in the Wasteway, but no neonates were captured (although remains of two neonate GGS were found in the stomachs of two of 28 bullfrogs captured in the Wasteway). In addition, 10 snakes captured in the Wasteway weighed less than 40 grams, indicating that GGS have been breeding at Volta WA (Dickert 2003). In 2004, 13 GGS were captured in the same locations as the 2003 study. The study concluded that construction dewatering may have been the cause for the dramatic decrease in GGS captured (Sloan 2004). Three snakes captured in 2003 were recaptured in 2004 and this, along with the presence of neonates in 2003, is an indication that a viable, breeding population is present at Volta WA (Sloan 2004). Finally, in 2006, seven GGS were captured in the same locations as the 2003 and 2004 studies (Sousa 2006).

5 ENVIRONMENTAL BASELINE

In 2001, Reclamation, USFWS, CDFG, and Grassland Water District entered into Long-term Water Supply Agreements for Refuge Water Supply pursuant to Sections 3406(d)(1) and 3406(d)(2) of Title 34 of Public Law 102-575 of the CVPIA, which included the Volta WA. An Environmental Assessment and Initial Study (EA/IS) was prepared between January and November 2000 to disclose any potential environmental impacts in accordance with NEPA and CEQA. The Finding of No Significant Impact (FONSI) found that the expected changes to on-refuge habitats resulting from implementation of the refuge water supply agreements would not adversely affect fish, wildlife or plant species nor would there be any significant effect on species listed pursuant to the Endangered Species Act. According to this document, it is CDFG's goal to preserve existing populations of all threatened and endangered species and to improve the overall conditions and status of those species, where possible (Reclamation, et al. 2001). It also states that the quality of water supplies to the Volta WA varies. Habitat management on the wildlife areas within the San Joaquin River Basin has been impaired by unreliable and poor quality water supplies. The lack of firm water supplies of adequate quality has limited management flexibility and the diversity of wetland habitat and species (Reclamation, et al. 2001).

There is suitable habitat for GGS in the waters and wetlands throughout Volta WA, including the Wasteway and Pond 10 wetlands area. GGS has been captured within the Volta WA, including Pond 10, 26 and the Wasteway near these two ponds.

The Volta Wasteway is the primary supply canal for the Northern Division of the GRCD. Water is released from the Delta Mendota Canal (DMC) to the Wasteway through a variety of control structures for distribution throughout the Northern GRCD. The Wasteway conveys flows directly to the Volta WMA through lift pumps, and to the GRCD through releases out of control structures located in Pond 10. Pond 10 structures are located at the terminus of the Wasteway and directly feed into the Santa Fe Canal Cross Channel, Mosquito Ditch and Malia Ditch (Figures 4 and 5). Wetlands in this region are typically flooded in late August to early September with flows in the Wasteway reaching 450 cfs. Wetland water elevations are maintained throughout the GRCD with maintenance flows from late October through the winter months to provide foraging and loafing habitat for waterfowl, shorebirds and other species. During the fall and winter maintenance flow periods, the Wasteway experiences flows up to 100 cfs. In the spring when soil temperatures are optimal for seed germination and successive plant growth, the wetlands are drained. Waters drained from these wetlands are conveyed to Mud Slough and Los Banos Creek which ultimately discharge to the San Joaquin River. Beginning in late April and continuing through the summer months, irrigation flows are delivered to the wetlands, filled and subsequently drained. During these periods the Wasteway can experience flows up to 150 cfs.

A tomato processing plant is located northwest of Volta WA and an abandoned swine production facility borders the south side of Volta WA. GRCD borders Volta WA to the north/northeast.

6 EFFECTS OF THE PROPOSED ACTION, INCLUDING CUMULATIVE EFFECTS

6.1 Direct Effects

Construction-related effects would be limited in extent to the immediate vicinity of the Volta Wasteway. Disturbance to the proposed action area would include a temporary increase of truck and worker foot traffic in what is currently a highly-frequented area (parking areas used by hunters). Some vegetation would be removed in the already disturbed areas as well as at the north and south embankments of the Wasteway for placement of erosion protection structures. The erosion protection structures would both be approximately 20 feet by 4 feet and would extend along the embankment from the end of the well discharge pipeline to three feet beyond the low water line to dissipate flow from the well. The structures would either be a Contech Armor Flex30S Erosion Control System or an engineer-approved equivalent. Placement of these two structures would require the removal of vegetative cover and may fill or crush burrows or crevices. The structures would remove potential GGS habitat and may obstruct movement of snakes. Because GGS utilize small mammal burrows and soil crevices as retreat sites, snakes may be crushed, buried, or otherwise injured from construction activities. Snakes may be run over by construction equipment or other vehicles accessing the construction sites. Construction disturbance may cause GGS to move; however, there is suitable habitat throughout Volta WA and GRCD for snakes to utilize.

Volta Wildlife Area Water Quality Monitoring Locations

Weekly EC Monitoring Locations

- ★ Inflow
- ★ Flowthru
- ★ Outflow

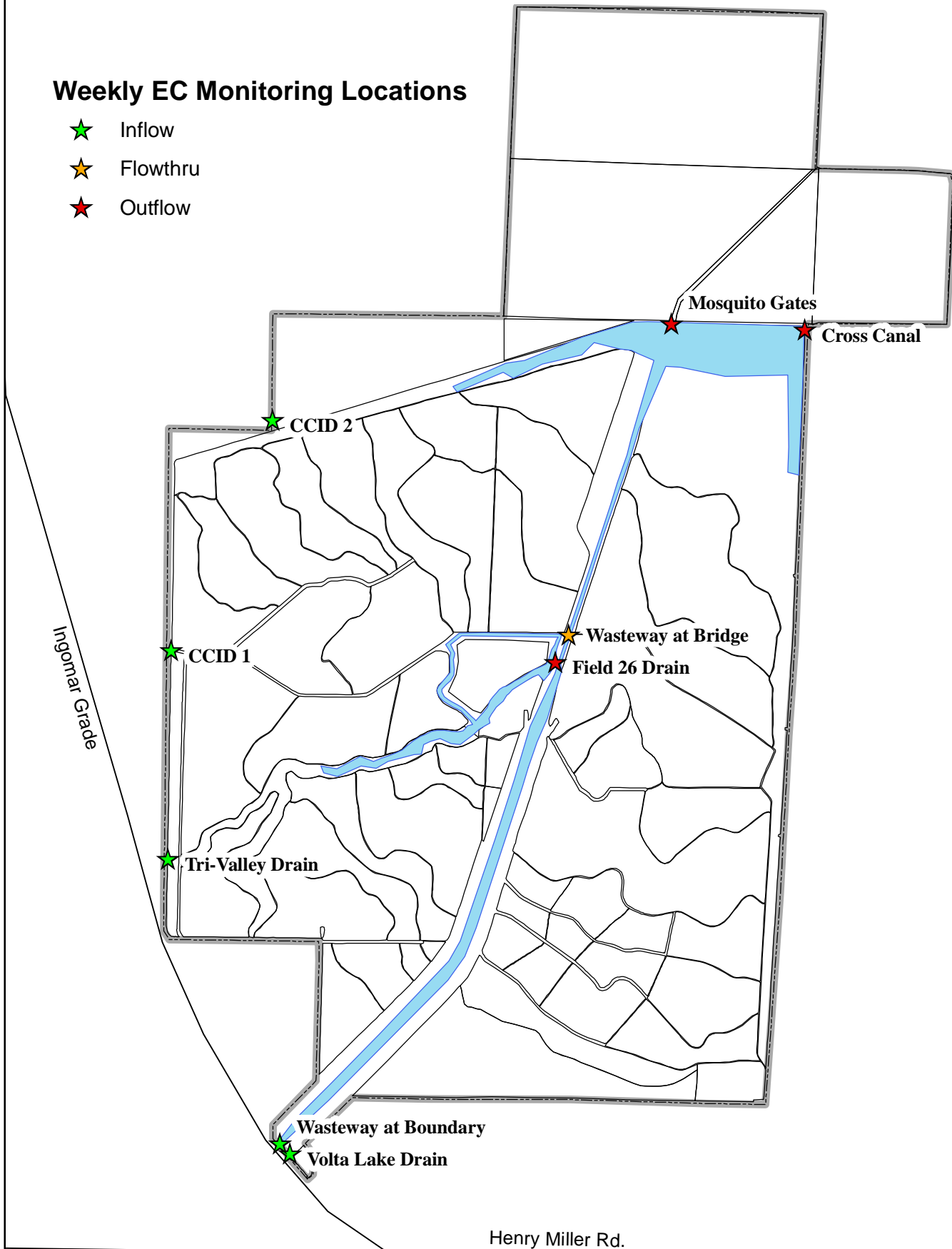


Figure 4 - Volta WA Water Quality Monitoring Locations



Figure 5 Volta Field/Pond Map

The proposed project would not induce or facilitate growth as it is diversifying the water supply at the Volta WA to benefit wildlife and does not provide additional water supplies for municipal users.

6.2 Indirect Effects

Potential benefits to GGS include additional water supply (Level 4) in the spring and summer. Seasonal wetlands throughout the units (ponds) at Volta, which provide suitable habitat for GGS, would receive more water, which would potentially benefit GGS.

Natural and managed seasonal wetlands and riparian communities often depend on surface water/groundwater interactions for part or all of their water supply. Subsurface drawdown related to groundwater pumping could result in hydrologic changes to nearby streams and marshes, potentially affecting GGS habitat. Before groundwater pumping is initiated, the hydrogeologic conditions of the two wells would be examined to minimize the potential risk of depleting surface water sources and adversely affecting hydrologic conditions of GGS habitat.

While the effects of poor water quality on GGS are unknown, it is believed that bioaccumulation of trace elements, pesticides and other contaminants does occur in snakes and can result in adverse biological effects. The proposed action is not likely to result in adverse effects to water quality in Volta WA; however, a water quality monitoring plan would be implemented to monitor surface and groundwater at the wells and in the Wasteway (see Appendix C). Parameters to be measured include the basic characteristics of the water (e.g., minerals), Total Dissolved Solids (TDS), nutrients (e.g., nitrates), pesticides, herbicides and insecticides, and metals (e.g., Mercury, Boron, Selenium, Arsenic and Uranium). Permanent or temporary impacts to water quality are not anticipated as the quality would be continuously tested and pumping would cease if the quality is compromised.

6.3 Interdependent and Interrelated Effects

In addition to the Proposed Action, other groundwater wells are being funded by ARRA throughout the Central Valley. The nearest area to Volta WA where additional groundwater wells are proposed is Grasslands Water District (GWD) to the north. There are currently 12 wells proposed by GWD, however, it is unknown at this time how many would actually be constructed. Particularly in the San Joaquin Valley, groundwater pumping can lead to subsidence, which could affect seasonal wetlands in Volta WA. However, during this three-year pilot program, continuous testing of the aquifer would occur to assess the effects of pumping on the aquifer. Should significant changes to the aquifer be identified, pumping of the two production wells at Volta WA would cease.

If not for the Proposed Action, additional Incremental Level 4 water would not likely be available to Volta WA and GRCD. This water would help to optimize wildlife habitat, including that for GGS, in an area where GGS are already known to exist.

6.4 Cumulative Effects

The Proposed Action is a pilot program and if at the end of the three years the program is determined to be no longer needed or beneficial, CDFG will continue to manage their water for GGS habitat. Potential benefits may occur to GGS in that additional water may be available during spring and summer when GGS is active and requires a permanent water source. No other state or local actions are proposed in the area that would impact GGS.

6.5 Measures to Avoid Take of Special-status Species

Standard Avoidance and Minimization Measures for GGS would be implemented during construction (see below). By implementing these measures, take of these special-status species would be reduced or eliminated. Since GGS habitat is not being directly impacted, there are no mitigation or conservation measures, or compensation/set-asides proposed.

Giant Garter Snake

To avoid take of GGS, the following measures would be implemented:

- Confine movement of heavy equipment to existing roadways to minimize habitat disturbance.
- Construction activity within habitat should be conducted between May 1 and October 1. This is the active period for GGS and direct mortality is lessened, because snakes are expected to actively move and avoid danger. Between October 2 and April 30, contact the USFWS Sacramento office to determine whether additional measures are necessary to minimize and avoid take.
- Confine clearing to the minimal area necessary to facilitate construction activities. Flag and designate avoided GGS habitat within or adjacent to the project area as Environmentally Sensitive Areas. This area should be avoided by all construction personnel.
- Construction personnel should receive a USFWS-approved worker environmental awareness training. This training instructs workers to recognize GGS and its habitat(s).
- The project area should be surveyed for GGS 24 hours before construction activities. Survey of the project area should be repeated if a lapse in construction activity for two weeks or greater has occurred. If a snake is encountered during construction, activities shall cease until appropriate corrective measures have been completed or it has been determined that the snake will not be harmed. Report any sightings and any incidental take to the USFWS immediately by telephone at (916) 414-6600.
- After completion of construction activities, remove any temporary fill and construction debris, and wherever feasible, restore disturbed areas to pre-project conditions. Restoration work may include replanting species removed from banks or with emergent vegetation in the active channel.

- In the event that take cannot be avoided, contact the USFWS for information before starting the action.

In addition to those measures identified above, the measures (water quality and biological monitoring) identified in the attached Monitoring Plan (Appendix C) will be incorporated as part of the Pilot Project to lessen the potential for impacts to GGS

7 CONCLUSION/DETERMINATION OF EFFECT

Placement of the two wells would be limited in extent to only the immediate vicinity of the Wasteway. Total disturbance to the action area would include temporarily increased truck and worker foot traffic in what is currently a highly-frequented area as a result of well placement. Some vegetation will be removed along the north and south embankments of the Wasteway for placement of erosion control structures (approximately 4 feet by 20 feet) and could potentially affect GGS if in the area as this is potential GGS habitat.

Groundwater from the production wells placed on either side of the Wasteway would be pumped into the Wasteway and delivered downstream throughout the Volta WA and could be delivered to other refuges in the area (i.e., GRCD). Water quality would be continually tested at the outflow and if determined to be of poor quality, pumping into the Wasteway would cease at the end of the three-year pilot study.

The proposed action may benefit GGS in that it would provide additional water during the snake's active period (spring and summer).

The proposed action *may affect, is likely to adversely affect* GGS. Restrictions during well placements and avoidance and minimization measures would help to reduce the potential for take of GGS.

The proposed project would have *no effect* on the following ESA listed species due to a lack of suitable habitat in the action area and/or lack of occurrences in this area:

- San Joaquin kit fox
- Longhorn fairy shrimp
- Vernal pool fairy shrimp
- Vernal pool tadpole shrimp
- Valley elderberry longhorn beetle
- Delta smelt
- Central Valley steelhead
- California tiger salamander, central population
- California red-legged frog
- Blunt-nosed leopard lizard
- Fresno kangaroo rat

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9 LIST OF CONTACTS/CONTRIBUTORS/PREPARERS

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10 GLOSSARY

Action area – all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.

Cumulative effects – those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur in the action area of the Federal action subject to consultation.

Effects of the action – refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline.

Environmental baseline – includes the past and present impacts of all Federal, State or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process.

Indirect effects – Indirect effects are those that are caused by the action(s) and are later in time, but are still reasonably certain to occur.

Interdependent actions – Interdependent actions are those that have no significant independent utility apart from the action that is under consideration, i.e., other actions would not occur but for this action.

Interrelated actions – Interrelated actions are those that are part of a larger action and depend on the larger action for their justification, i.e., this action would not occur but for a larger action.

Likely to jeopardize the continued existence of – to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of that species.

May affect, not likely to adversely affect – the appropriate conclusion when effects on a listed species are expected to be discountable, insignificant or completely beneficial.

Beneficial effects – contemporaneous positive effects without any adverse effects.

Insignificant effects – relate to the size of the impact and should never reach the scale where take would occur.

Discountable effects – those that are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect or evaluate insignificant effects; or (2) expect discountable effects to occur.

May affect, likely to adversely affect – the appropriate finding if any adverse effect may occur to listed species or critical habitat as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant or beneficial.

Appendices

Appendix A USFWS Species List dated October 26, 2009



**United States Department of the Interior
FISH AND WILDLIFE SERVICE**

Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825



July 20, 2009

Document Number: 090720022704

Tamara LaFramboise
Bureau of Reclamation
2800 Cottage Way
MP-410
Sacramento, CA 95825

Subject: Species List for Volta Wildlife Area Level 2 Refuge Water Diversification Project

Dear: Ms. LaFramboise

We are sending this official species list in response to your July 20, 2009 request for information about endangered and threatened species. The list covers the California counties and/or U.S. Geological Survey 7½ minute quad or quads you requested.

Our database was developed primarily to assist Federal agencies that are consulting with us. Therefore, our lists include all of the sensitive species that have been found in a certain area *and also ones that may be affected by projects in the area*. For example, a fish may be on the list for a quad if it lives somewhere downstream from that quad. Birds are included even if they only migrate through an area. In other words, we include all of the species we want people to consider when they do something that affects the environment.

Please read Important Information About Your Species List (below). It explains how we made the list and describes your responsibilities under the Endangered Species Act.

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be October 18, 2009.

Please contact us if your project may affect endangered or threatened species or if you have any questions about the attached list or your responsibilities under the Endangered Species Act. A list of Endangered Species Program contacts can be found at www.fws.gov/sacramento/es/branches.htm.

Endangered Species Division



**U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office**

**Federal Endangered and Threatened Species that Occur in
or may be Affected by Projects in the Counties and/or
U.S.G.S. 7 1/2 Minute Quads you requested**

Document Number: 090720022704

Database Last Updated: January 29, 2009

Quad Lists

INGOMAR (403B)

Listed Species

Invertebrates

Branchinecta longiantenna

longhorn fairy shrimp (E)

Branchinecta lynchi

vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardii

vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus

delta smelt (T)

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)

Amphibians

Ambystoma californiense

California tiger salamander, central population (T)

Rana aurora draytonii

California red-legged frog (T)

Reptiles

Gambelia (=Crotaphytus) sila

blunt-nosed leopard lizard (E)

Thamnophis gigas

giant garter snake (T)

Mammals

Dipodomys nitratooides exilis

Fresno kangaroo rat (E)

Vulpes macrotis mutica

San Joaquin kit fox (E)

VOLTA (403C)

Listed Species

Invertebrates

- Branchinecta longiantenna*
longhorn fairy shrimp (E)
- Branchinecta lynchi*
vernal pool fairy shrimp (T)
- Desmocerus californicus dimorphus*
valley elderberry longhorn beetle (T)
- Lepidurus packardii*
vernal pool tadpole shrimp (E)

Fish

- Hypomesus transpacificus*
delta smelt (T)
- Oncorhynchus mykiss*
Central Valley steelhead (T) (NMFS)

Amphibians

- Ambystoma californiense*
California tiger salamander, central population (T)
- Rana aurora draytonii*
California red-legged frog (T)

Reptiles

- Gambelia (=Crotaphytus) sila*
blunt-nosed leopard lizard (E)
- Thamnophis gigas*
giant garter snake (T)

Mammals

- Dipodomys nitratoideus exilis*
Fresno kangaroo rat (E)
- Vulpes macrotis mutica*
San Joaquin kit fox (E)

County Lists

No county species lists requested.

Key:

- (E) *Endangered* - Listed as being in danger of extinction.
- (T) *Threatened* - Listed as likely to become endangered within the foreseeable future.
- (P) *Proposed* - Officially proposed in the Federal Register for listing as endangered or threatened.
- (NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
- Critical Habitat* - Area essential to the conservation of a species.
- (PX) *Proposed Critical Habitat* - The species is already listed. Critical habitat is being proposed for it.
- (C) *Candidate* - Candidate to become a proposed species.
- (V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.
- (X) *Critical Habitat* designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, **or may be affected by** projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online [Inventory of Rare and Endangered Plants](#).

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our [Protocol](#) and [Recovery Permits](#) pages.

For plant surveys, we recommend using the [Guidelines for Conducting and Reporting Botanical Inventories](#). The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal [consultation](#) with the Service.

During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our [Map Room](#) page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. [More info](#)

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be October 18, 2009.

U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office
Federal Endangered and Threatened Species that Occur in
or may be Affected by Projects in the Counties and/or
U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 090812104726

Database Last Updated: January 29, 2009

No quad species lists requested.

County Lists

Merced County

Listed Species

Invertebrates

Branchinecta conservatio

Conservancy fairy shrimp (E)

Critical habitat, Conservancy fairy shrimp (X)

Branchinecta longiantenna

Critical habitat, longhorn fairy shrimp (X)

longhorn fairy shrimp (E)

Branchinecta lynchi

Critical habitat, vernal pool fairy shrimp (X)

vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus

valley elderberry longhorn beetle (T)

Lepidurus packardii

Critical habitat, vernal pool tadpole shrimp (X)

vernal pool tadpole shrimp (E)

Fish

Oncorhynchus mykiss

Central Valley steelhead (T) (NMFS)

Critical habitat, Central Valley steelhead (X) (NMFS)

Amphibians

Ambystoma californiense

California tiger salamander, central population (T)

Critical habitat, CA tiger salamander, central population (X)

Rana aurora draytonii

California red-legged frog (T)

Critical habitat, California red-legged frog (X)

Reptiles

Gambelia (=Crotaphytus) sila

blunt-nosed leopard lizard (E)

Thamnophis gigas

giant garter snake (T)

Mammals

Dipodomys ingens

giant kangaroo rat (E)

Dipodomys nitratooides exilis

Fresno kangaroo rat (E)

Vulpes macrotis mutica

San Joaquin kit fox (E)

Plants

Castilleja campestris ssp. succulenta

Critical habitat, succulent (=fleshy) owl's-clover (X)

succulent (=fleshy) owl's-clover (T)

Chamaesyce hooveri

Critical habitat, Hoover's spurge (X)

Hoover's spurge (T)

Neostapfia colusana

Colusa grass (T)

Critical habitat, Colusa grass (X)

Orcuttia inaequalis

Critical habitat, San Joaquin Valley Orcutt grass (X)

San Joaquin Valley Orcutt grass (T)

Orcuttia pilosa

Critical habitat, hairy Orcutt grass (X)

hairy Orcutt grass (E)

Tuctoria greenei

Critical habitat, Greene's tuctoria (=Orcutt grass) (X)

Greene's tuctoria (=Orcutt grass) (E)

Proposed Species

Amphibians

Rana aurora draytonii

Critical habitat, California red-legged frog (PX)

Key:

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Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. See our Protocol and Recovery Permits pages.

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Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

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Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates

was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts. [More info](#)

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be November 10, 2009.

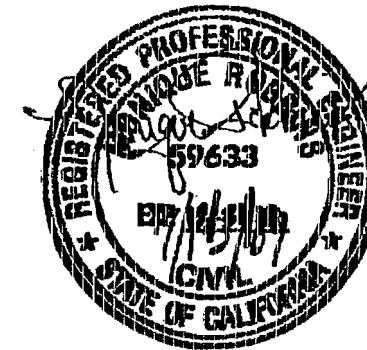
Appendix B Construction Drawing Set

VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT

VOLUME 2 OF 2

DRAWINGS

JULY 2009



CONSTRUCTION DRAWING SET

Franson Civil Engineers Team

Franson Civil Engineers

Malcolm Pirnie

Detail Reference Legend

VIEW/SECTION/DETAIL TITLE LABELS

A REFERS TO THE VIEW/SECTION DESIGNATION LABEL (ALPHA)

I REFERS TO THE DETAIL DESIGNATION LABEL (NUMERIC)

VIEW/SECTION REFERENCES

PA REFERS TO THE VIEW/SECTION DESIGNATION LABEL (TOP)

P4 REFERS TO THE SHEET WHERE THE VIEW/SECTION IS SHOWN (BOTTOM)

DETAIL REFERENCES

I REFERS TO THE DETAIL DESIGNATION LABEL (TOP)

P7 REFERS TO THE SHEET WHERE THE DETAIL IS SHOWN (BOTTOM)

Volume 2

Drawings

G SET (GENERAL SHEETS)

G1	COVER SHEET
G2	SHEET INDEX, LEGEND, & LOCATION MAPS
G3	AERIAL PHOTO SITE PLAN & ACCESS LOCATIONS

P SET (PLAN & PROFILE SHEETS)

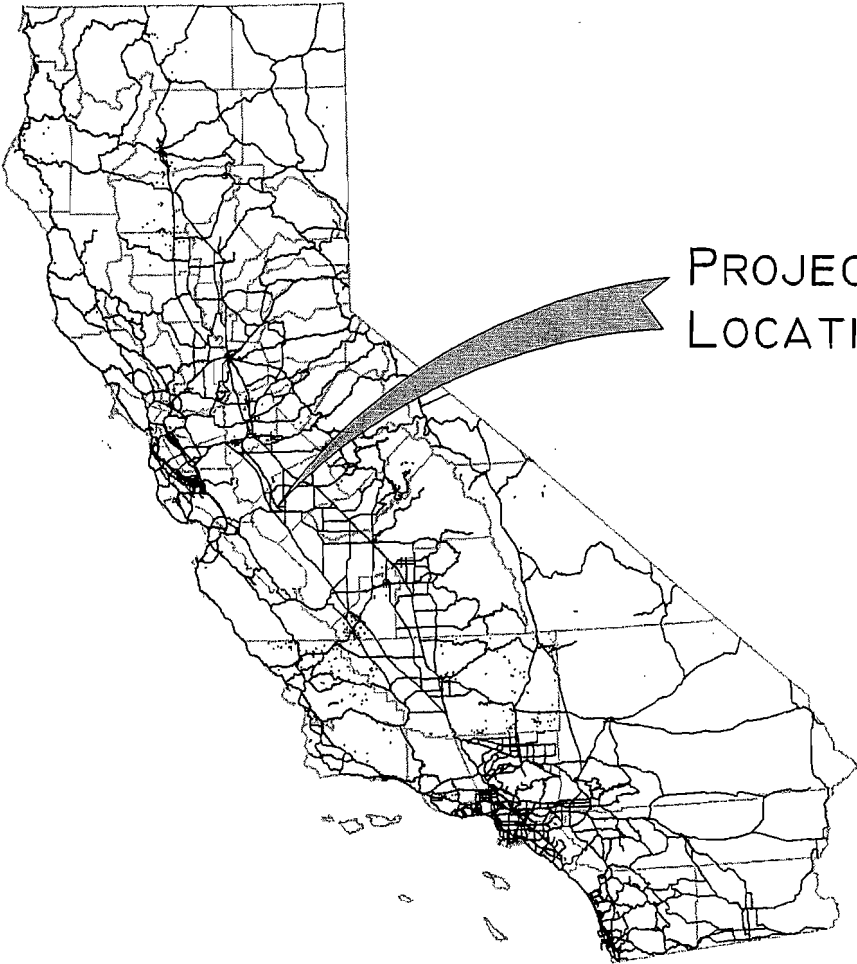
P1	PRODUCTION WELL #1 PLAN
P2	PRODUCTION WELL #2 PLAN
P3	PRODUCTION WELLS #1 & #2 PROFILES

W SET (WELL DRAWINGS)

W1	WELL DETAILS
----	--------------

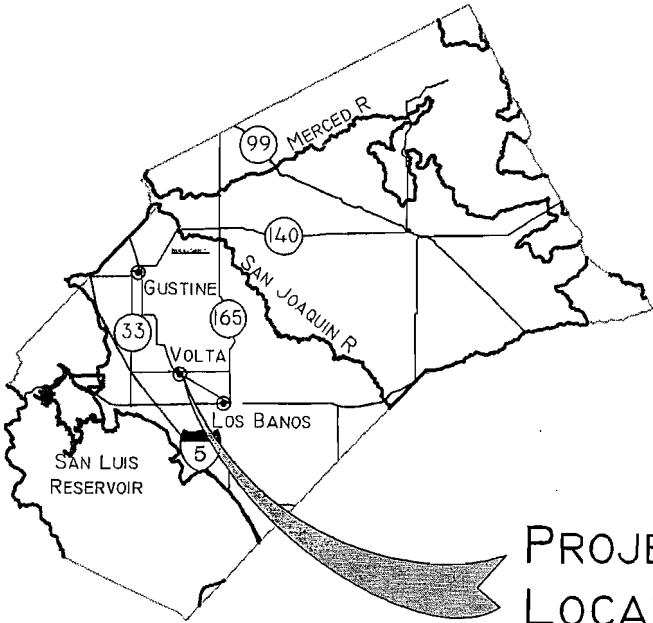
D SET (DETAIL DRAWINGS)

D1	WELL #1 PUMP SLAB
D2	WELL #2 PUMP SLAB
D3	DISCHARGE DETAILS - STAINLESS STEEL OPTION
D4	DISCHARGE DETAILS - PRECAST CONCRETE OPTION
D5	PUMP CONNECTION DETAILS
D6	FENCE & THRUST BLOCK DETAILS
D7	METER MANHOLE DETAILS



State of California

PROJECT
LOCATION



Merced County

PROJECT
LOCATION

VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT

SHEET INDEX, LEGEND, & LOCATION MAPS

G2 Index-1 Loc.dwg
H:\C\J\INTS-USRR Area\1 - 2006 IDIO Contract\5 - Project\Volta\PROJECTV1.4
Drawings
LAYOUT: Index

JOB NO.
CA 00000001

SHEET
G2 OF G3

DESIGNER: VINCE HOGGE
DRAFTSMAN: PAUL CURR
DATE: JULY 2009
INTS: LJ
NO. 1

CHECKED: REVIEWED:

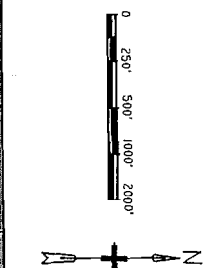
PROJECT LEADER: LAYNE JENSEN
PRINT DATE: SEP. 02, 2009

REVISIONS

NO.	DATE	INTS.	DESCRIPTION
1	JULY 2009	LJ	RESPOND TO BUREAU OF RECLAMATION COMMENTS

FRANSON CIVIL ENGINEERS TEAM

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63 OF 63

SHEET

VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT

AERIAL PHOTO SITE PLAN & ACCESS LOCATIONS

JOB NO.

Topo & Aerial Map.dwg
HACUENTS-USBR Area - 2006 IDIQ Contract's - Projects/Volta/PROJECT1.4
Drawings
LAYOUT: Layout1

CA. 0000001

DESIGNER: VINCE HOGGE
DRAFTSMAN: MATT GUMR

CHECKED:
REVIEWED:

PROJECT LEADER: LAYNE JENSEN
PRINT DATE: SEP. 02, 2009

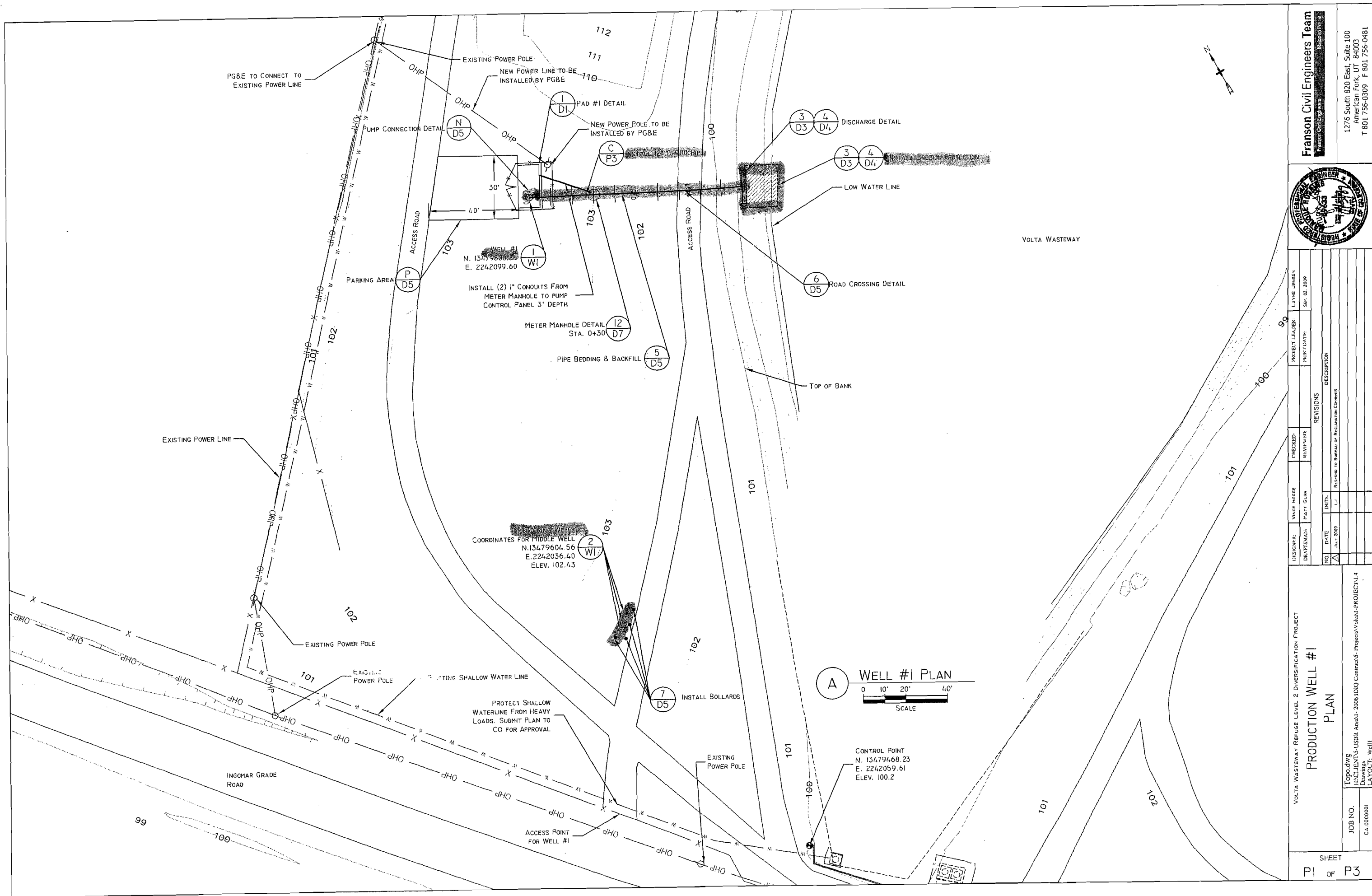
REVISIONS

NO.	DATE	INITIALS	DESCRIPTION
1	JULY 2009	LJ	RESPOND TO BUREAU OF RECLAMATION COMMENTS



Franson Civil Engineers Team
Franson Civil Engineers Malcolm Pirnie

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PROJECT LEADER:	LANE JENSEN	DATE:	SEP 02 2009
CHECKED:	VINCE HOGGE	DATE:	
DRAWN BY:	MATT GUIN	DATE:	
DATE:	JUL 2009	DATE:	
NO.	1	NO.	1
DESCRIPTION:	VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT		
REVISIONS:	REVISIONS		
NO.	1	DESCRIPTION	Response to Bureau of Reclamation Comments
DATE	JUL 2009	DATE	
NO.	1	NO.	1
DESCRIPTION	Response to Bureau of Reclamation Comments		

VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT

PRODUCTION WELL #1

PLAN

Topo.dwg

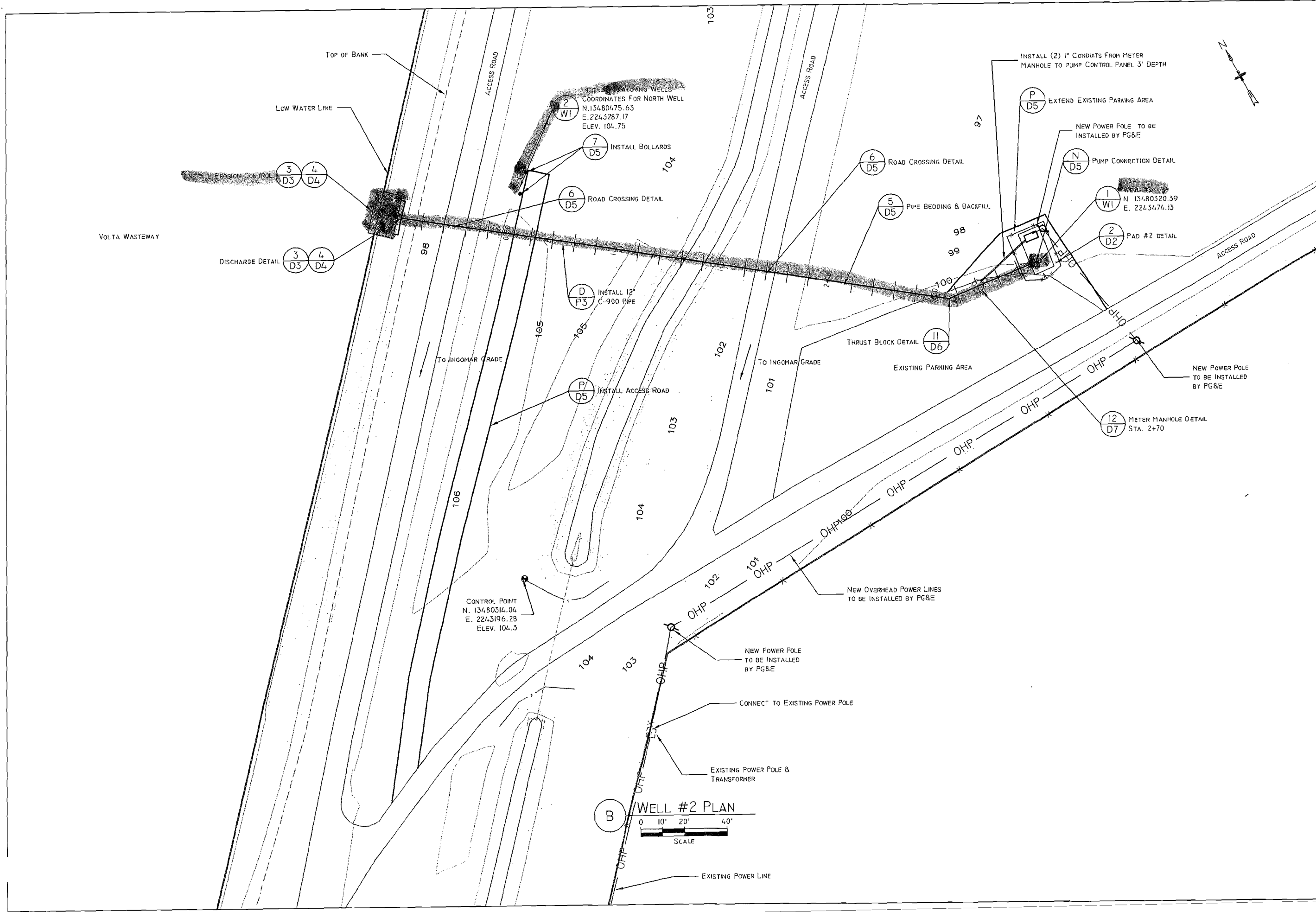
ENCLOSURE USBK Area 1-2006 IDQ Control 5-Project's Value-PROJECT 1.4

Drawings

LAYOUT: Well1

SHEET

PI OF P3



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NO.	DATE	INTS.	DESCRIPTION
1	JUL 2009	LJ	Respond to Bureau of Reclamation Comments

VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT

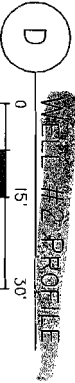
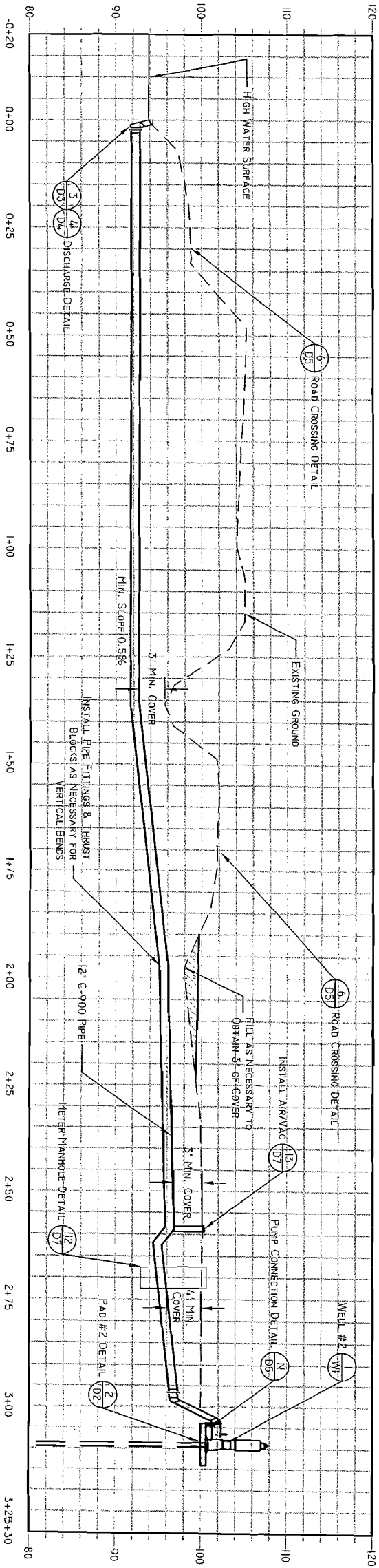
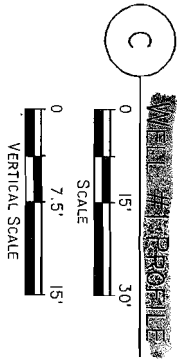
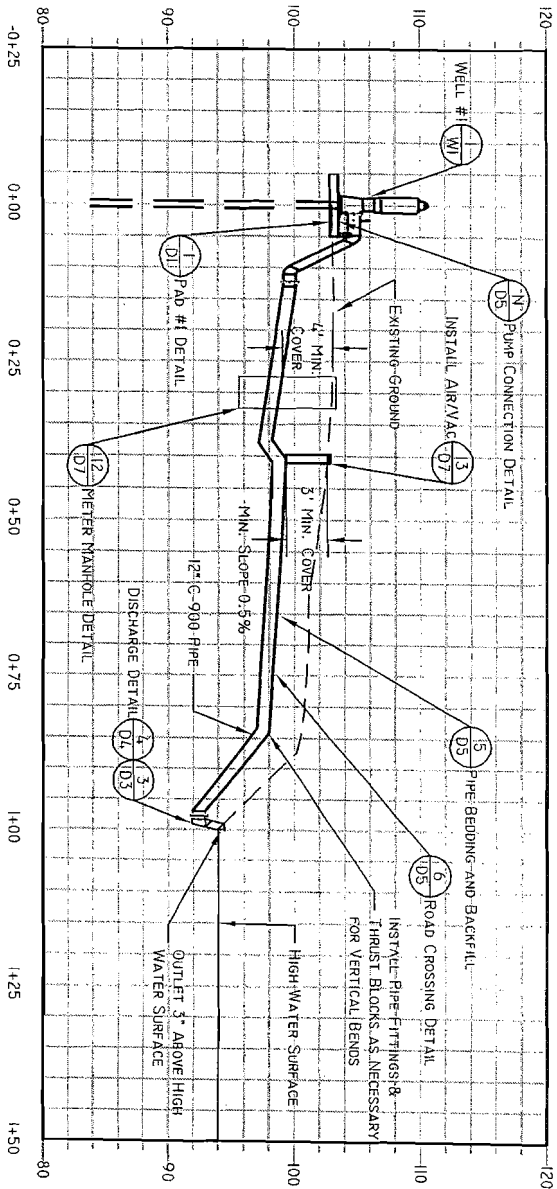
PRODUCTION WELL #2

PLAN

Topo.dwg
H:\CLIENTS-USBR Areas\1-2006 IDIQ Contract\5- Projects\Volta\PROJECT\1.4
Drawings
LAYOUT: Well 2

JOB NO.
CA 0000001

SHEET
P2 OF P3



NOTE: DISCHARGE DETAIL TO BE INSTALLED WITH THE TOP OF THE WELL 3' ABOVE HIGH WATER

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Franson Civil Engineers Malcolyn Penie

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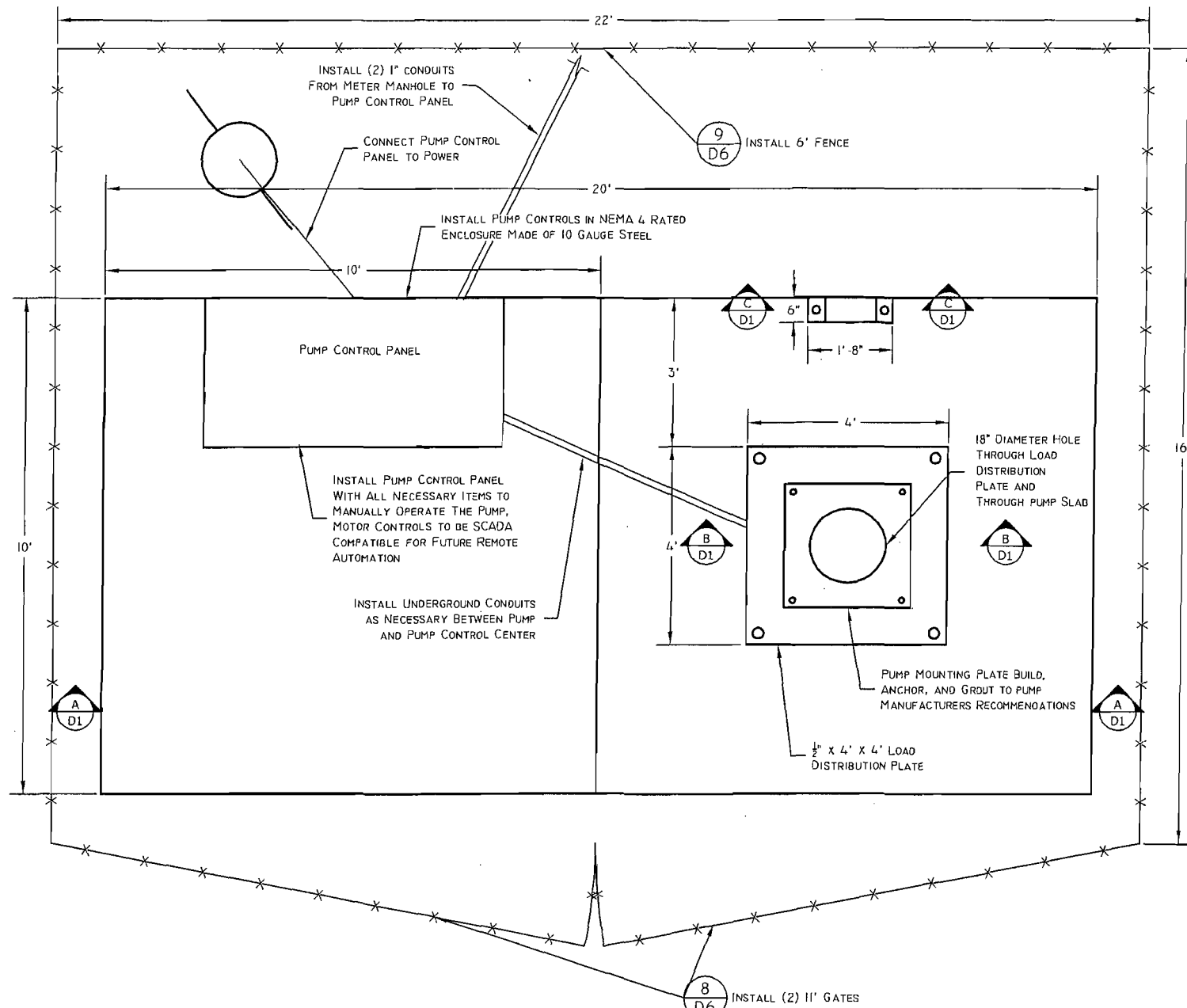
PROJECT LEADER: LAYNE JENSEN
PRINT DATE: SEP. 02, 2009

DESIGNER: VINCE HOGGER
CHECKED: [blank]
DRAFTSMAN: MATT GUNN
REVIEWED: [blank]

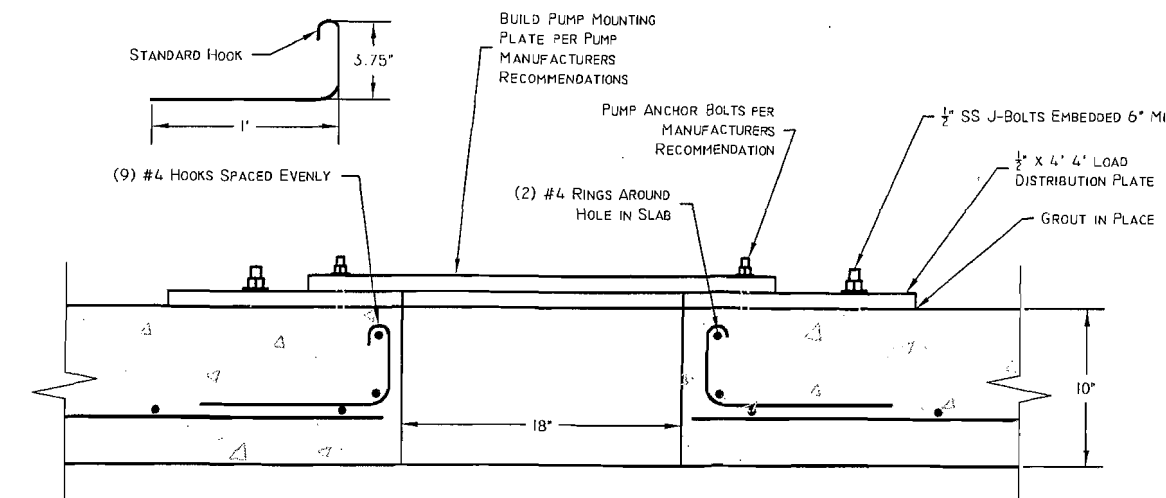
REVISIONS			
NO.	DATE	INITIALS	DESCRIPTION
1	JULY 2009	LJ	RESPOND TO BUREAU OF RECLAMATION COMMENTS

PRODUCTION WELLS #1 & #2 PROFILES

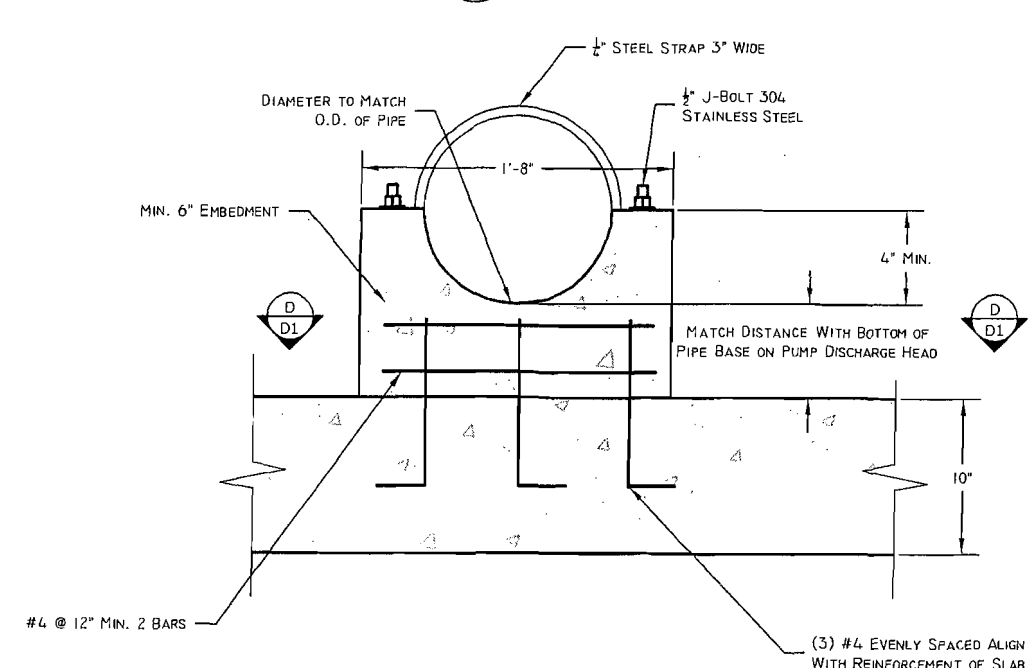
JOB NO. CA.0000001
Topo.dwg
H:\CLIENTS-USBR Area\1- 2006 IDIQ Contract\5- Projects\Volta\1-PROJECT\1.4 Drawings
LAYOUT: Profiles



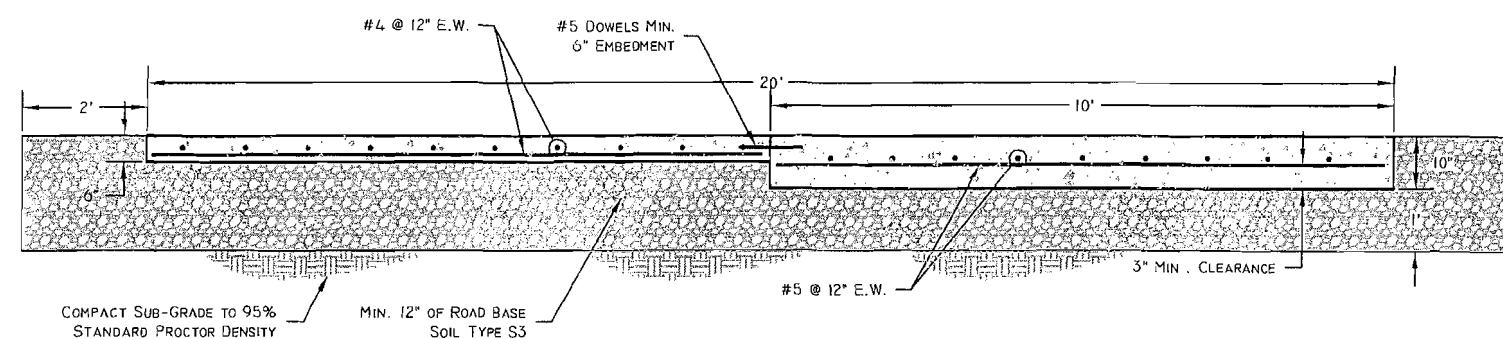
1 PLAN VIEW
SCALE: 1" = 3'



B SECTION VIEW PUMP BASE
SCALE: 1" = 1'

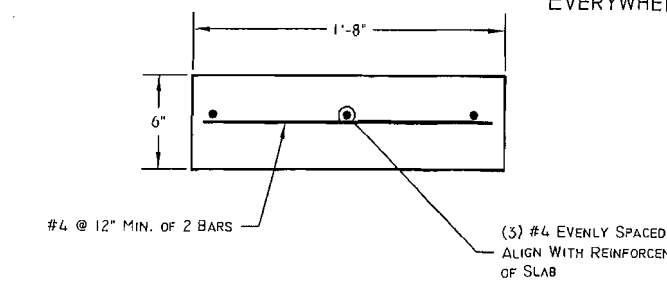


C PIPE SUPPORT PIER
SCALE: 1" = 1'



A SECTION VIEW
SCALE: 1" = 1'

NOTE: MINIMUM REBAR CLEARANCE TO BE 3" WHERE CONCRETE CONTACTS SOIL. MINIMUM REBAR CLEARANCE EVERYWHERE ELSE TO BE 2".



D PIPE SUPPORT PIER CROSS SECTION
SCALE: 1" = 1'

Franson Civil Engineers Team

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PROJECT LEADER		PRINT DATE		REVISIONS		DESCRIPTION	
LAYNE JENSEN	SEP. 02, 2009						
RAY SCHIFFIELD		CHIEF					
DAVID SHANLEY		DESIGNER					
NO.	DATE	INTS.	REV.	BY	DATE	DESCRIPTION	
1	JULY 2009	LJ				Revised to Bureau of Reclamation Comments	

VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT

WELL #1

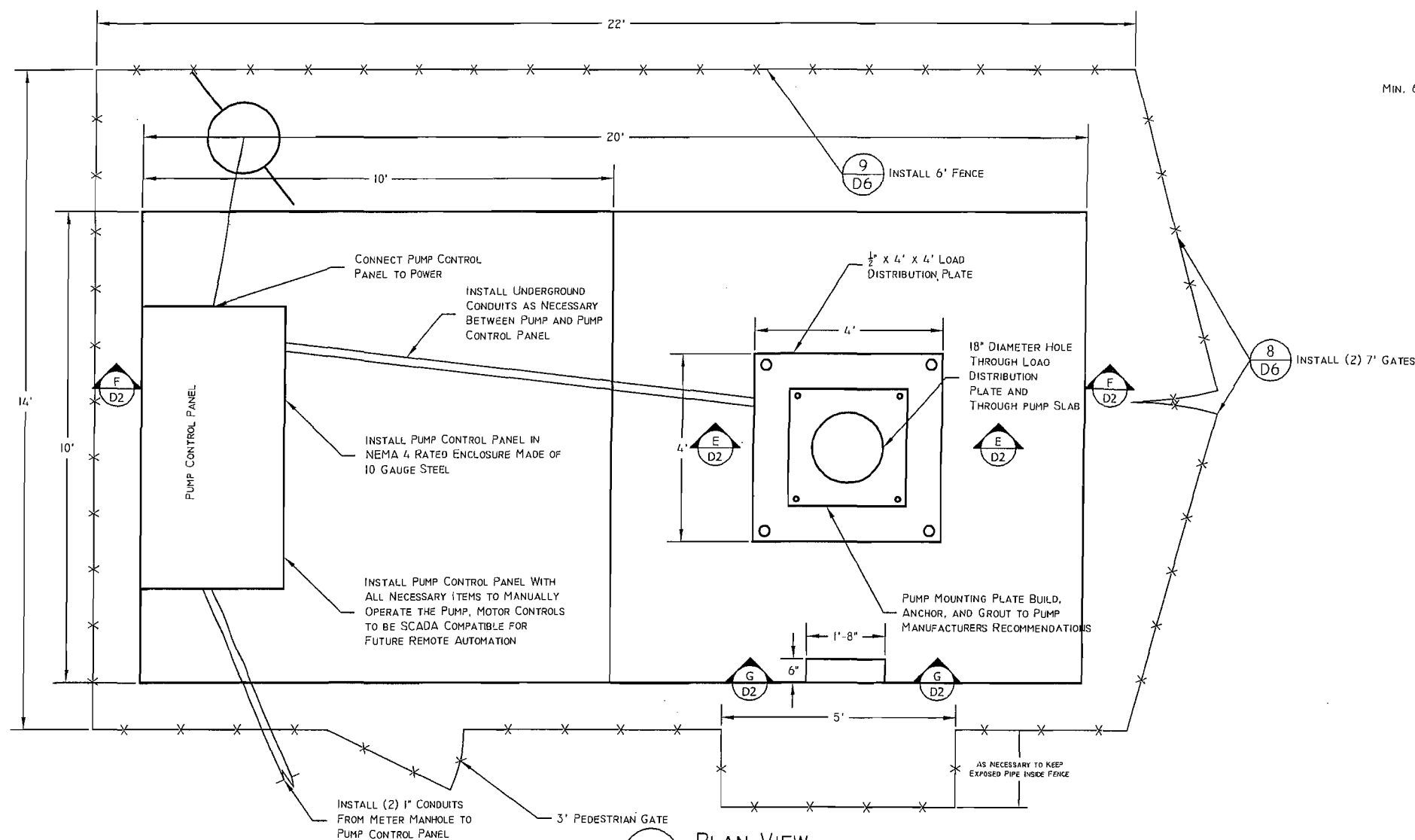
PUMP SLAB

Details.dwg
H:\CLIENTS\USBR Area\1-2006 IDIQ Contract\5. Project\Volta\PROJECT\1.4
LAYOUT.dwg

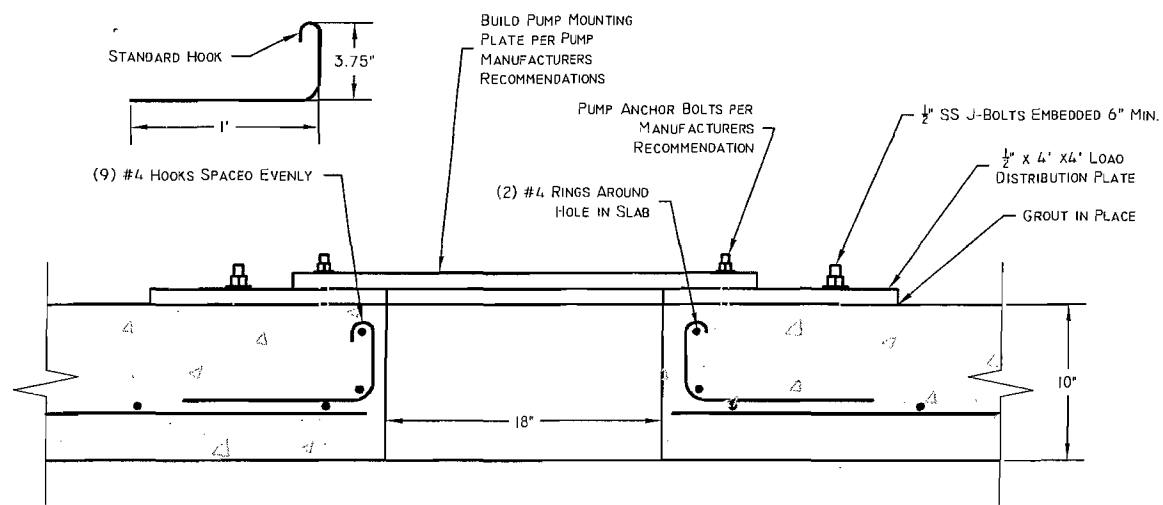
JOB NO.
CA-0000001

SHEET

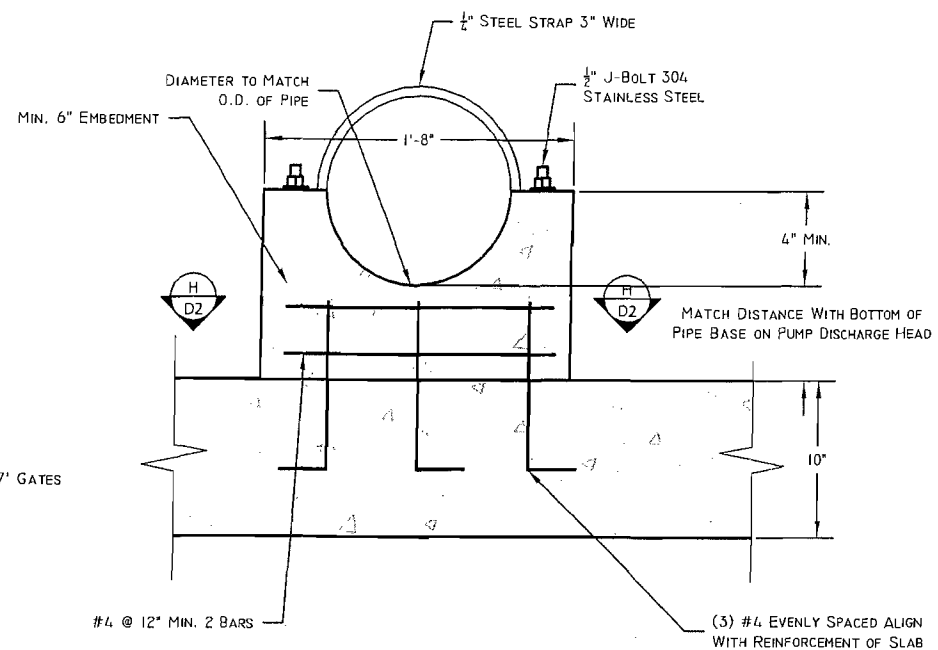
D1 OF D7



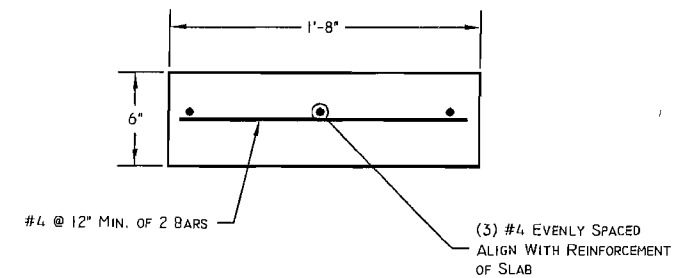
2 PLAN VIEW
SCALE: 1" = 3'



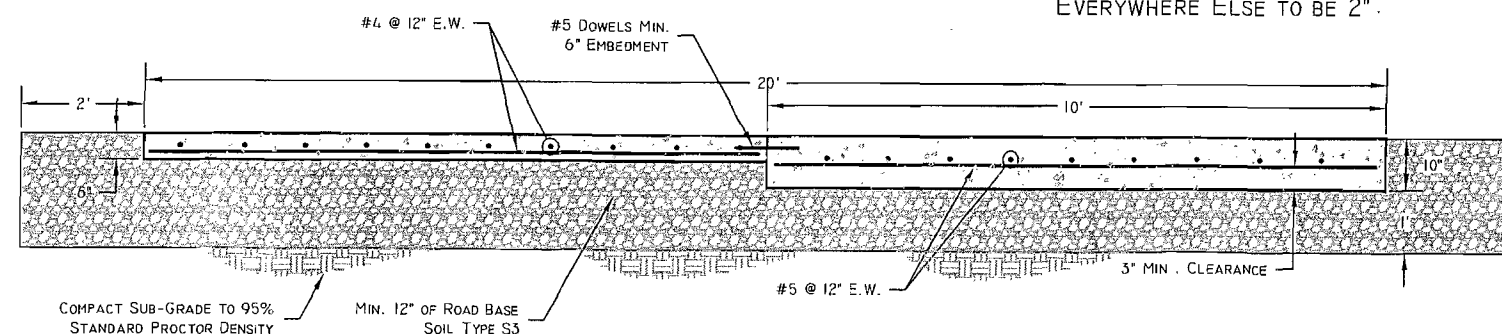
E SECTION VIEW PUMP BASE
SCALE: 1" = 1'



G PIPE SUPPORT PIER
SCALE: 1" = 1'



H PIPE SUPPORT PIER CROSS SECTION
SCALE: 1" = 1'



F SECTION VIEW
SCALE: 1" = 1'

NOTE: MINIMUM REBAR CLEARANCE TO BE 3" WHERE CONCRETE CONTACTS SOIL. MINIMUM REBAR CLEARANCE EVERYWHERE ELSE TO BE 2".

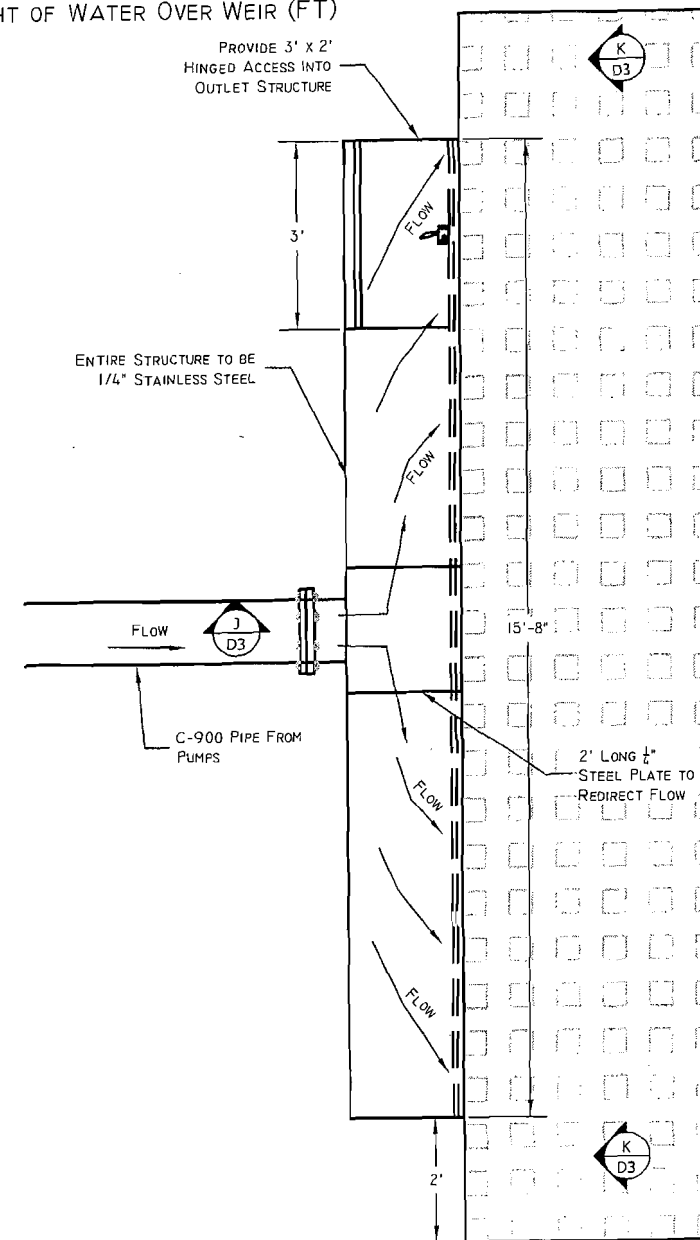
Franson Civil Engineers Team
Franson Civil Engineers
1276 South 820 East, Suite 100
American Fork, UT 84003
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PROJECT LEADER: LAYNE JENSEN		PRINT DATE: SEP. 02, 2009		DESCRIPTION: REPAIR TO BUREAU OF RECLAMATION CONCRETE	
DESIGNER: RAY SCHOFIELD	CHECKED: RAY SCHOFIELD	DRAWN: MATT GIBB	DATE: JULY 2009	NO. 1	REVISIONS
VOLTA WASTEWATER RECLAMATION PROJECT					
WELL #2 PUMP SLAB					
Details dwg. HXCLJEN/US-UBSR Area/1-2006 IDIQ Contract/5- Project/Volant-PROJECT/14					
JOB NO. CA 0000001					

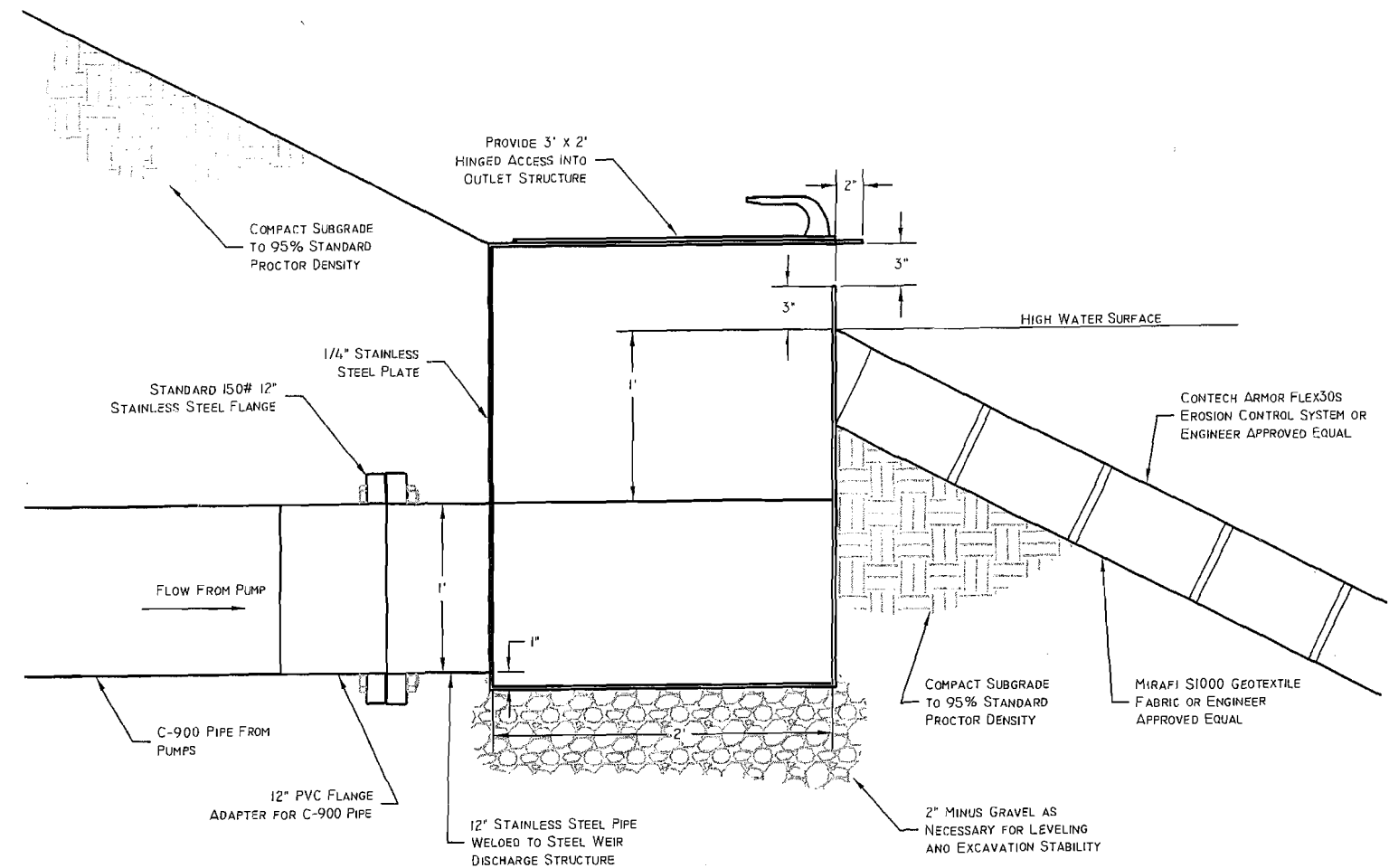
SHEET
D2 OF D7

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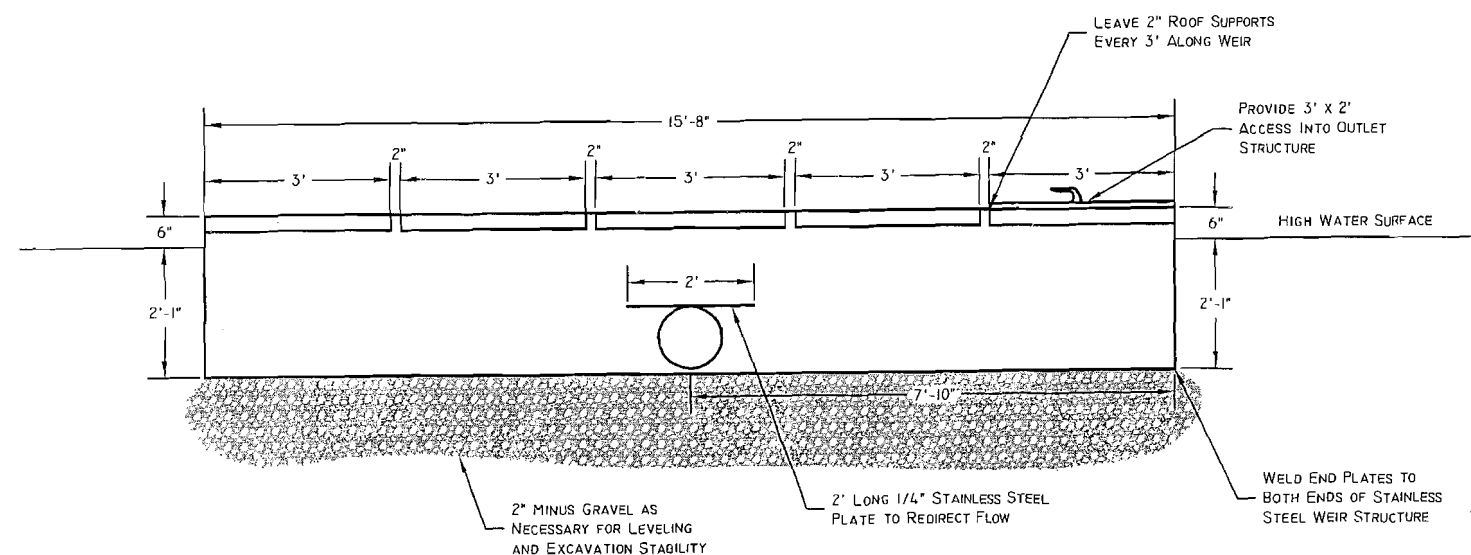
NOTE: FLOW MEASUREMENT CAN BE TAKEN AT THE WEIR DISCHARGE BY MEASURING THE HEIGHT OF WATER OVER THE WEIR PLATE.
 $Q = [3.33 \times H^{3/2} \times (3 - 0.2H)] \times 5$
 Q=FLOW RATE(CFS)
 H=HEIGHT OF WATER OVER WEIR (FT)



3 STAINLESS STEEL DISCHARGE PLAN
 SCALE: 1" = 3'



J STAINLESS STEEL DISCHARGE SECTION
 SCALE: 1" = 1'



K STAINLESS STEEL DISCHARGE - FRONT VIEW
 SCALE: 1" = 3'

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 Franson Civil Engineers
 Malcom Payne

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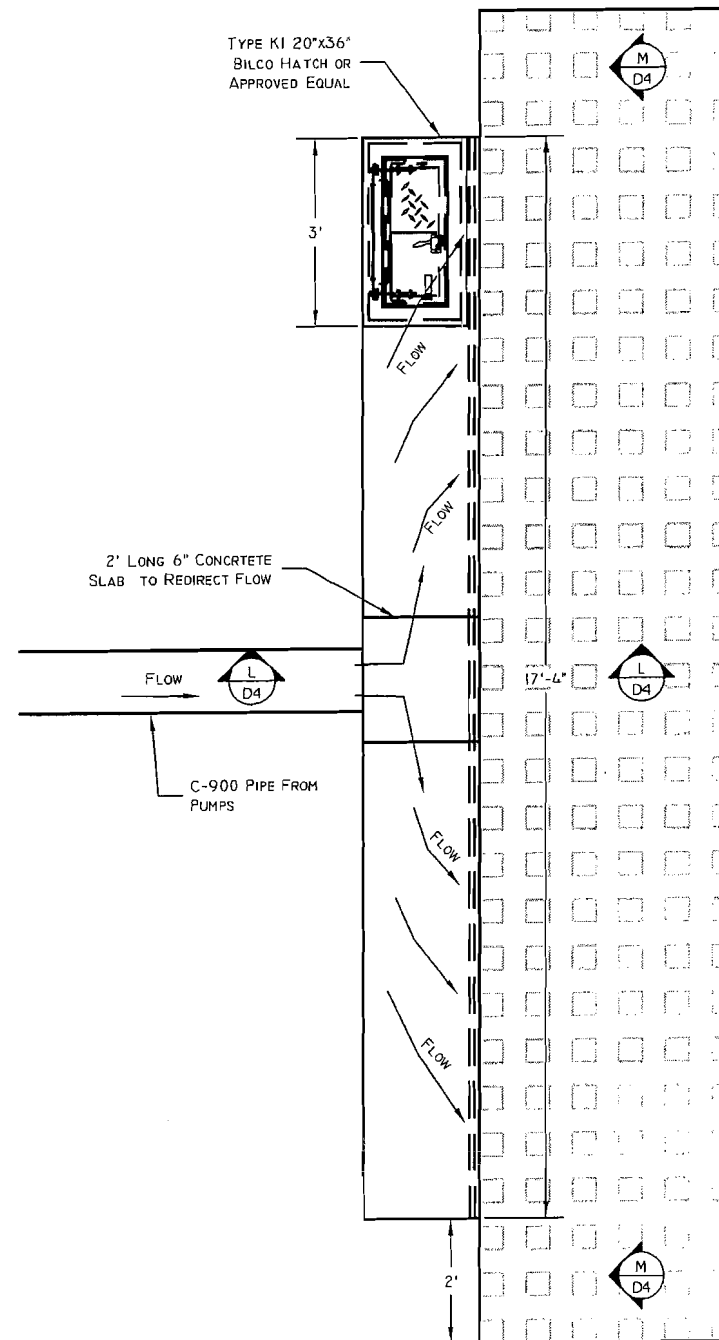
DESIGNER	DRAWN	CHECKED	PROJECT LEADER	DATE	REVISIONS	DESCRIPTION
VINCE HOGRE	MATT CURR	REVIEWED	LAYNE JENSEN	SEP. 02, 2009		
NO.	DATE	INTS.				
1	JULY 2009	LJ				RESPONSE TO BUREAU OF RECLAMATION COMMENTS

VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT	
DISCHARGE DETAILS	
STAINLESS STEEL OPTION	
Details.dwg	PROJECTS-USBR Area1 - 2006 IDIQ Contract - Project/VOLTA-PROJECT/4
JOB NO.	Drawings
C1 0000001	LA 1001 Discharge S
SHEET	
D3 OF D7	

$$Q = [3.33 \times H^{3/2} \times (3 - 0.2H)] \times 5$$

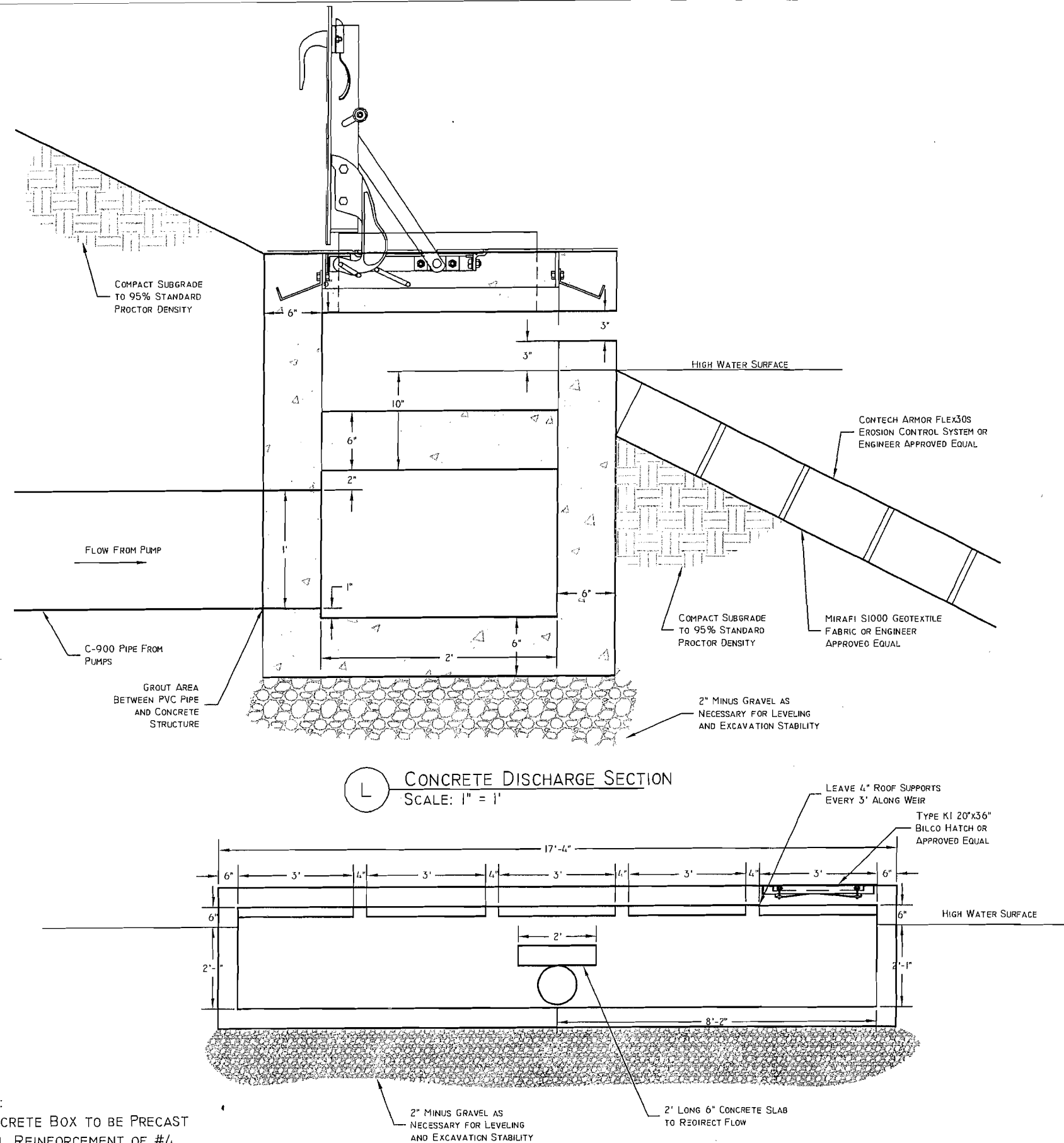
$$Q = \text{FLOW RATE (CFS)}$$
$$Q = \text{FLOW RATE (CFS)}$$

TYPE KI 20"x36"
BILCO HATCH OR
APPROVED EQUAL



4 CONCRETE DISCHARGE PLAN
SCALE: 1" = 3'

1. CONCRETE BOX TO BE PRECAST
2. MIN. REINFORCEMENT OF #4 BARS AT 12" ON CENTER EACH WAY



(M) CONCRETE DISCHARGE - FRONT VIEW
SCALE: 1" = 3'

Franson Civil Engineers Team
Franson Civil Engineers Malcolm Paine

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[illegible]

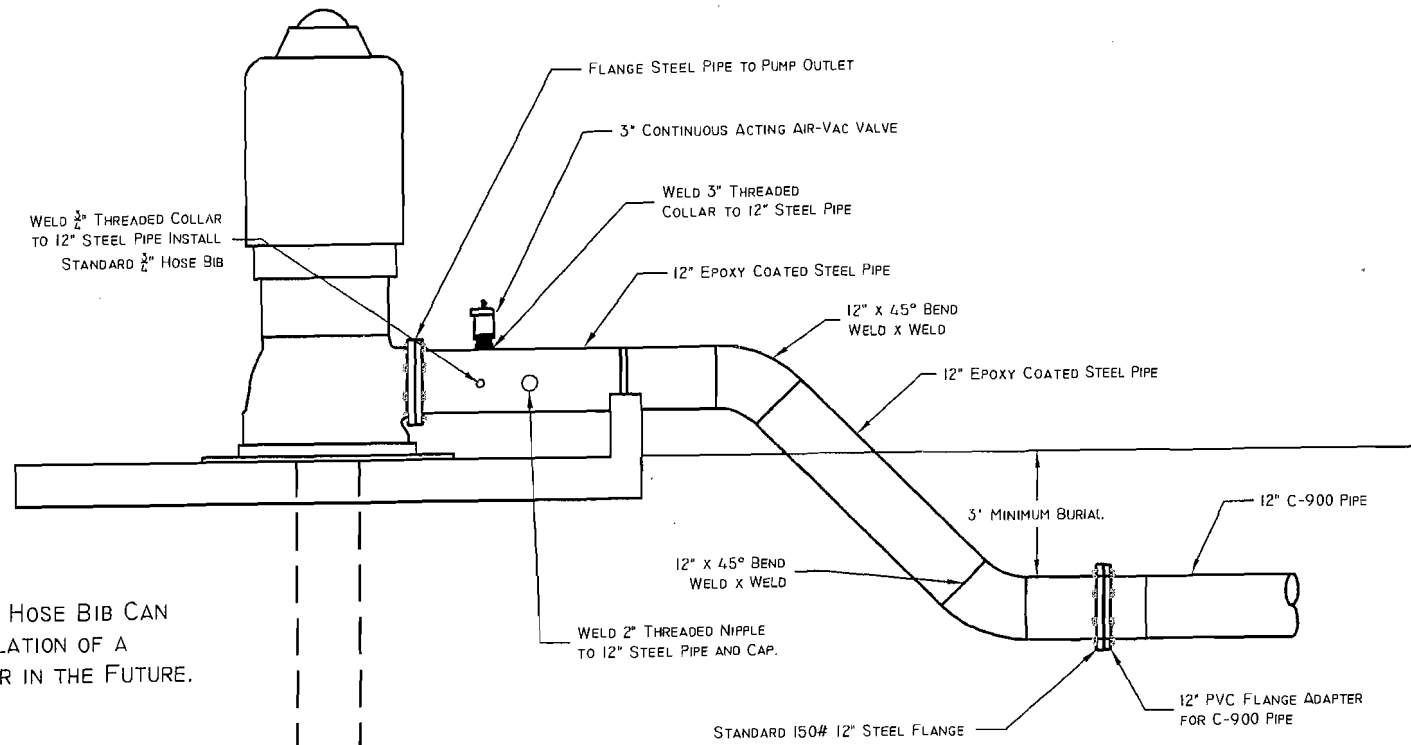
VOLTA WASTEWAY REFUGE LEVEL 2 DIVERSIFICATION PROJECT

DISCHARGE DETAILS PRECAST CONCRETE OPTION

Drawings
LAYOUT: Discharge C

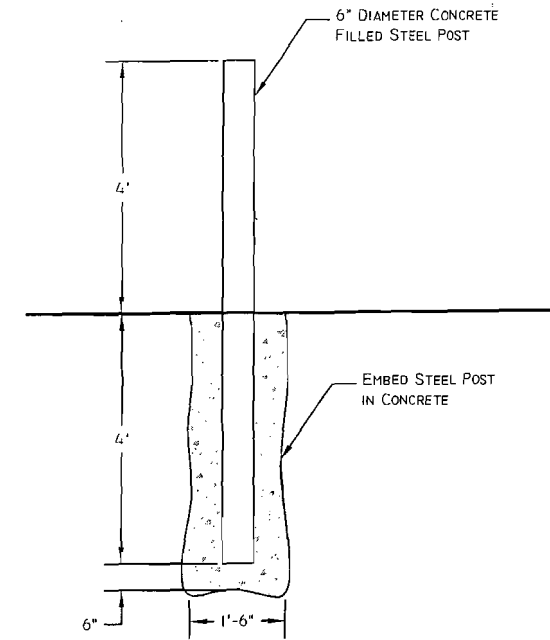
JOB NO.
C.A. 0000001

SHEET
D4 OF D7

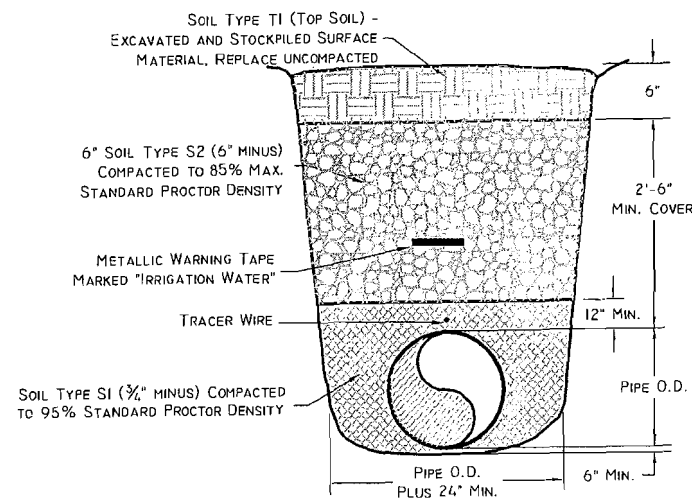


NOTE: COLLAR FOR 3/4" HOSE BIB CAN BE USED FOR INSTALLATION OF A PRESSURE TRANSDUCER IN THE FUTURE.

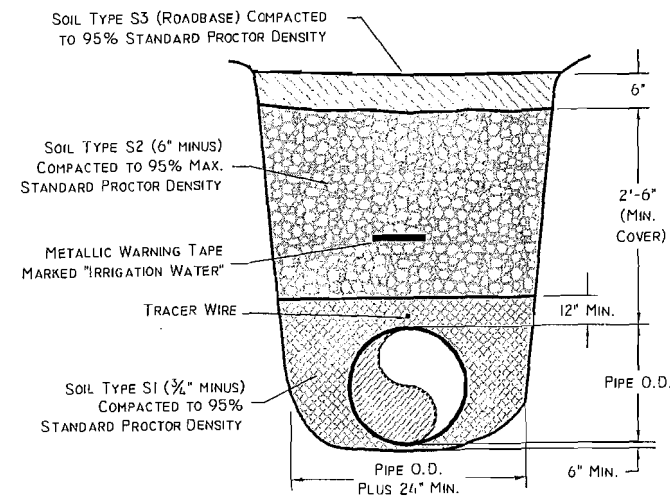
N PUMP CONNECTION DETAIL
SCALE: 1" = 3'



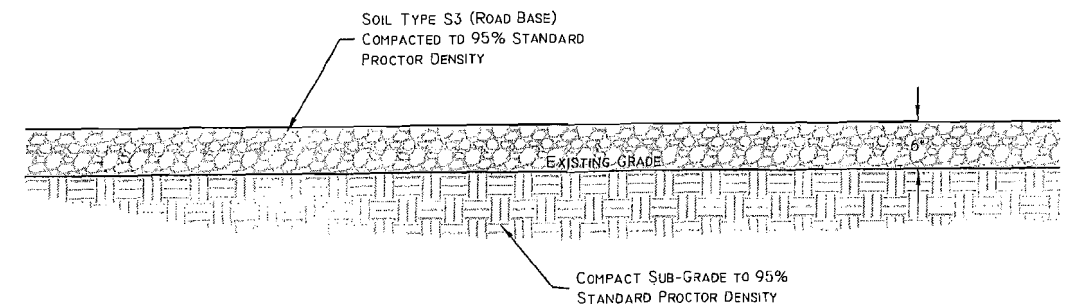
7 BOLLARD DETAIL
SCALE: 1" = 3'



5 PIPELINE BEDDING & BACKFILL
@ ALL OTHER LOCATIONS



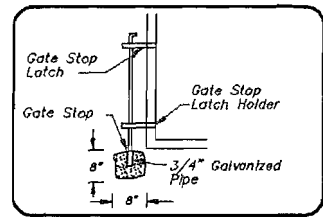
6 PIPELINE BEDDING & BACKFILL
@ ROAD CROSSING (W/ DIRT TOP)



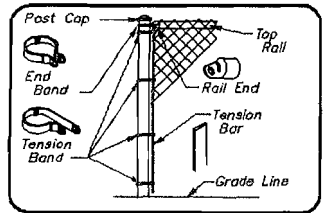
P PARKING LOT & ROAD DETAIL
SCALE: 1" = 2'



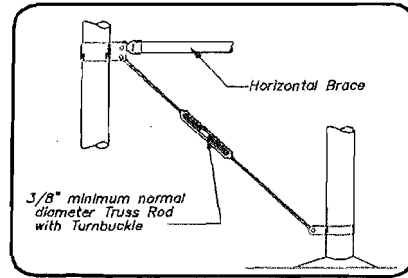
DESIGNER:	DRAWN:	CHECKED:	PROJECT LEADER:	DATE
VINCE HOGGE	MATT GURR	RIVIN WIDF	LAYNE JENSEN	SEP 02 2009
NO.	DATE	INTS.	DESCRIPTION	REVISIONS



GATE STOP ASSEMBLY DETAIL



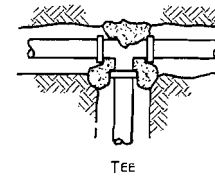
CORNER OR GATE POST DETAIL



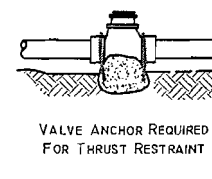
BRACE AND TRUSS ROD DETAIL

TABLE D2
CONCRETE THRUST BLOCK AREAS
NEEDED FOR REDUCERS

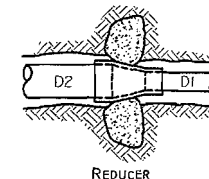
PIPE DIAMETER		AREA DIFF (IN ²)	THRUST BLOCK SOIL BEARING AREA (FT ²)
D1	D2		
42"	48"	424	28.3
36"	42"	368	24.5
30"	36"	311	20.7
24"	30"	254	17.0
21"	24"	106	7.1
18"	24"	198	13.2
15"	24"	276	18.4
14"	24"	298	19.9
18"	21"	92	6.1
15"	21"	170	11.3
12"	21"	233	15.6
10"	21"	268	17.9
15"	18"	78	5.2
14"	18"	101	6.7
12"	18"	141	9.4
10"	18"	176	11.7
8"	18"	204	13.6
12"	15"	64	4.2
10"	15"	98	6.5
8"	15"	126	8.4
10"	12"	35	2.3
8"	12"	63	4.2
6"	12"	85	5.7
8"	10"	28	1.9
6"	10"	50	3.4
6"	8"	22	1.5
4"	8"	38	2.5
4"	6"	16	1.0
2"	4"	9	0.6



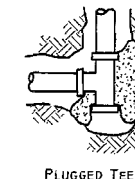
TEE



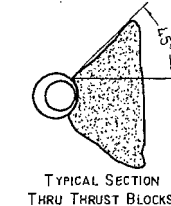
VALVE ANCHOR REQUIRED
FOR THRUST RESTRAINT



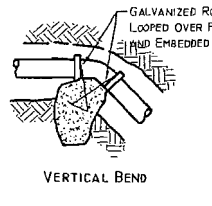
REDUCER



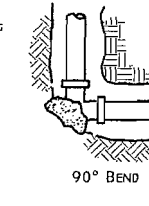
PLUGGED TEE



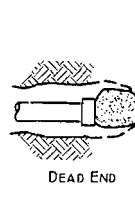
TYPICAL SECTION
THRU THRUST BLOCKS



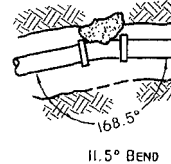
VERTICAL BEND



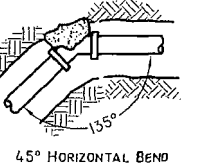
90° BEND



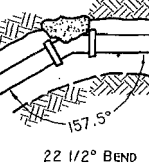
DEAD END



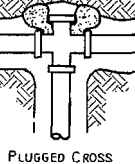
11.5° BEND



45° HORIZONTAL BEND



22 1/2° BEND



PLUGGED CROSS

THRUST BLOCK NOTES:

1. CONCRETE THRUST BLOCKING TO BE POURED AGAINST UNDISTURBED EARTH OR STRUCTURAL BACKFILL. APPROVED BY ENGINEER. PLACE VISQUEEN BARRIER BETWEEN CONCRETE AND PIPE. VALVE AND FITTING ANCHORS SHALL BE GALVANIZED RODS.
2. KEEP CONCRETE CLEAR OF JOINT AND ACCESSORIES.
3. REQUIRED BEARING AREAS AT FITTINGS SHALL BE AS REQUIRED IN NOTE 7 TO CONFORM TO TEST PRESSURE(S) AND ALLOWABLE SOIL BEARING STRESS(ES) STATED IN THE SPECIFICATIONS.
4. BEARING AREAS AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER BEARING AREAS AND BLOCKING DETAILS SHOWN ON THIS TYPICAL DETAIL.
5. ALL BURIED PIPING EXCEPT FLANGED, SCREWED, SOCKET WELD PVC OR WELDED STEEL PIPE SPECIFIED TO BE PRESSURE TESTED SHALL BE PROVIDED WITH CONCRETE THRUST BLOCKS AT ALL DIRECTION CHANGES UNLESS OTHERWISE NOTED.
6. THRUST BLOCKS SHALL NOT BE LOCATED OR SIZED TO ENCASE ADJACENT PIPES OR FITTINGS.
7. BEARING AREAS ARE BASED ON TEST PRESSURE OF 100 POUNDS PER SQUARE INCH AND AN ALLOWABLE SOIL BEARING STRESS OF 1500 POUNDS PER SQUARE FOOT. TO COMPUTE BEARING AREAS FOR DIFFERENT TEST PRESSURES AND SOIL BEARING STRESSES USE THE FOLLOWING EQUATION:
BEARING AREA = (TEST PRESSURE / 100) x (1500 / SOIL BEARING STRESS) x (TABLE VALUE)

11 WATER LINE THRUST BLOCK DETAIL
NOT TO SCALE

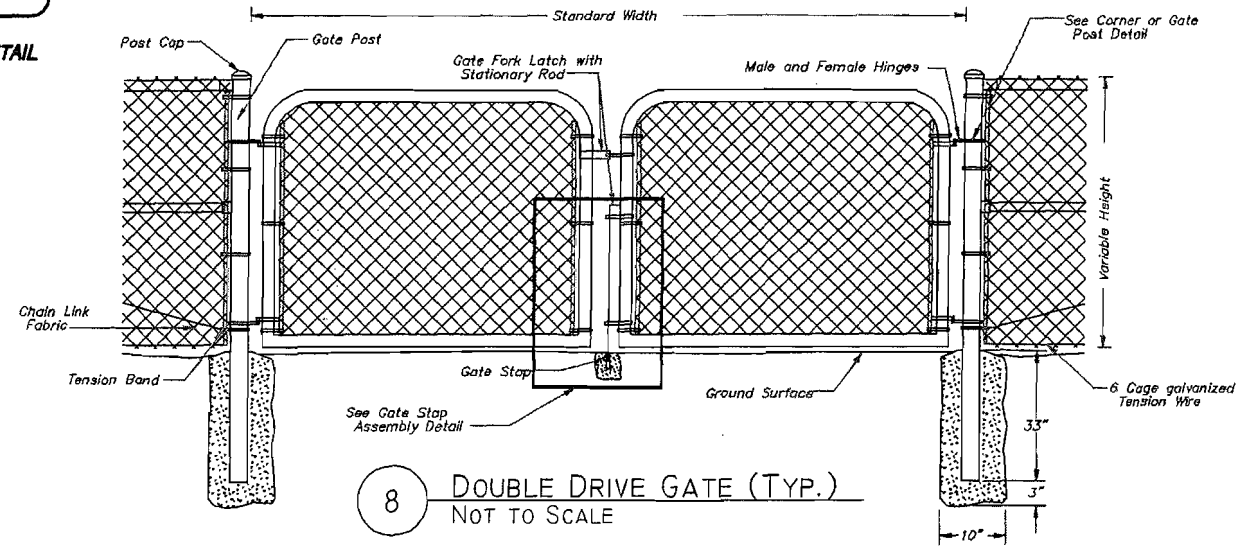
NOTES

1. Chain link fabric shall be 11 gage.
2. Chain link shall be 1" higher than top rail with either a knuckle salvage or a twisted and barbed salvage (Type I or Type II).
3. Tension wire shall be approximately 1" from ground surface.
4. Horizontal braces shall be placed on each side of gate and at each side of corner posts on 6" fences.
5. Horizontal brace is one half the distance between ground surface and top rail.
6. Stationary rods shall be placed in double drive gates if used.
7. Concrete for terminal, corner, and gate posts shall be 36" deep by 10" wide. Concrete for all other posts shall be 24" deep by 10" wide.
8. This drawing is not to scale.
9. Fencing installed on slopes may require additional bracing.
10. This drawing originally prepared by Sky Properties as a Power Canal & Pond Fencing Standard Chain Link.

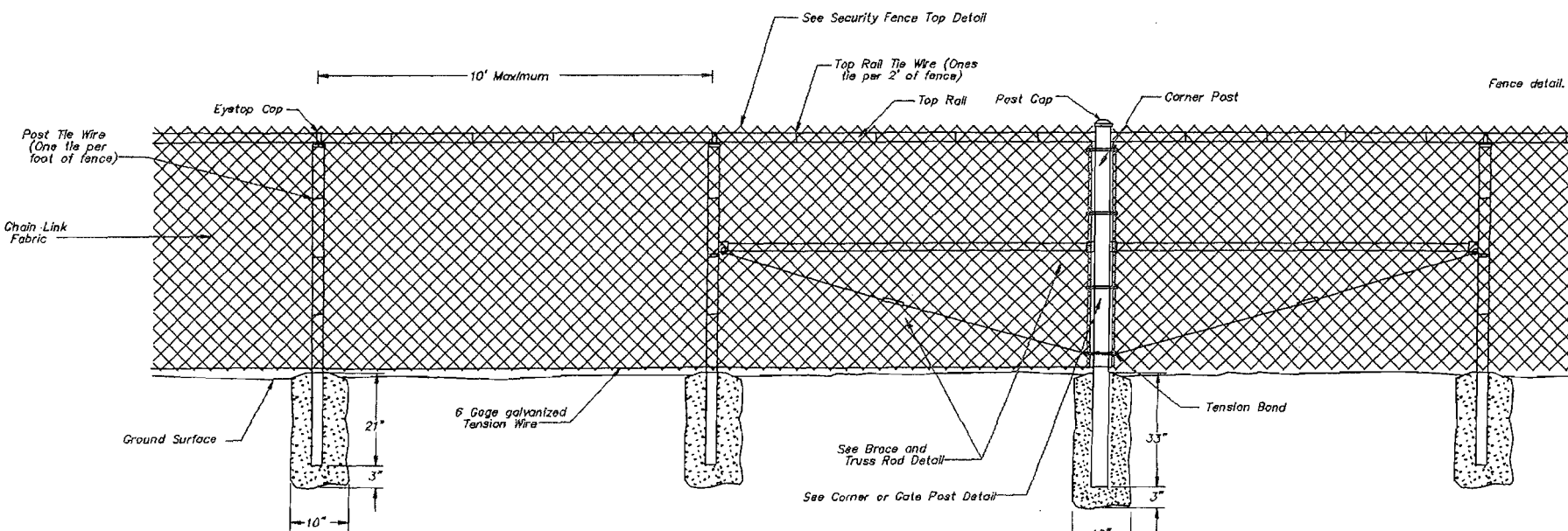
TABLE D1
CONCRETE THRUST BLOCK AREAS NEEDED

PIPE DIAMETER (IN)	PIPE AREA (IN ²)	THRUST BLOCK BEARING AREA REQUIRED				
		TEES, WYE, PLUG, CAP, VALVE (FT ²)	BEND (ANGLE DEGREES)			
			68° (FT ²)	45° (FT ²)	22.5° (FT ²)	11.25° (FT ²)
4"	13	0.8	0.9	0.6	0.3	0.2
6"	28	1.9	2.1	1.4	0.7	0.4
8"	50	3.4	3.7	2.6	1.3	0.7
10"	79	5.2	5.9	4.0	2.0	1.0
12"	113	7.5	8.4	5.8	2.9	1.5
15"	177	11.8	13.2	9.0	4.6	2.3
18"	254	17.0	19.0	13.0	6.6	3.3
21"	346	23.1	25.8	17.7	9.0	4.5
24"	452	30.2	33.7	23.1	11.8	5.9
30"	707	47.1	52.7	36.1	18.5	9.2
36"	1018	67.9	67.9	51.9	26.5	13.3
42"	1385	92.4	103.3	70.7	36.0	18.1
48"	1810	120.6	134.9	92.3	47.1	23.6

NOTE:
PRESSURE(P) = 100 PSI
SOIL STRENGTH (ALLOW) = 1500 PSF

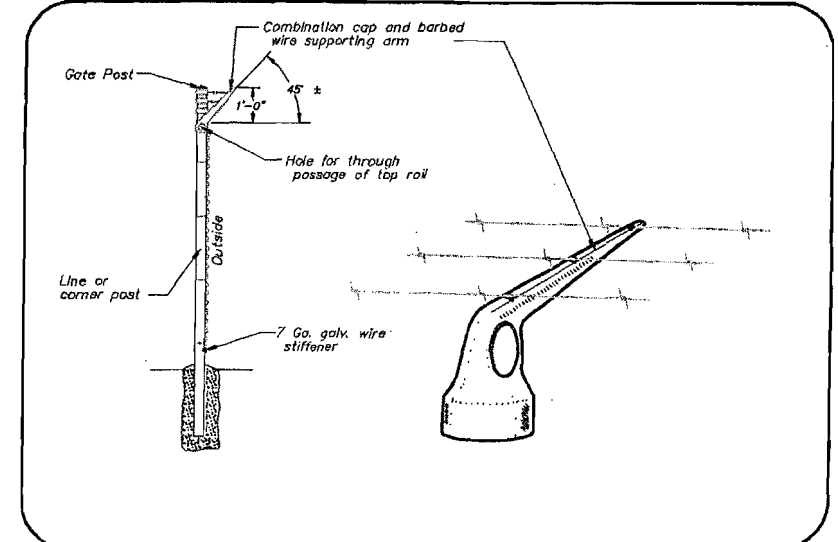


8 DOUBLE DRIVE GATE (TYP.)
NOT TO SCALE



9 STANDARD CHAIN LINK FENCE (TYP.)
NOT TO SCALE

10 CORNER POST (TYP.)
NOT TO SCALE



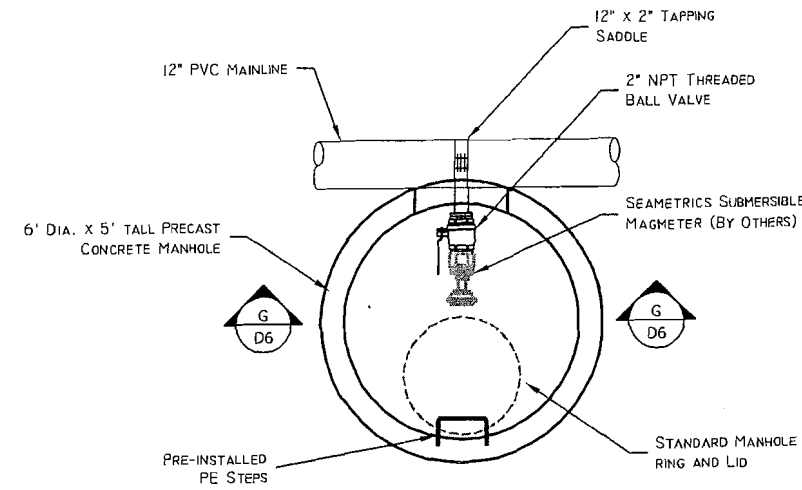
SECURITY FENCE TOP DETAIL

Franson Civil Engineers Team
Franson Civil Engineers
1276 South 820 East, Suite 100
American Fork, UT 84003
T 801 756-0309 F 801 756-0481

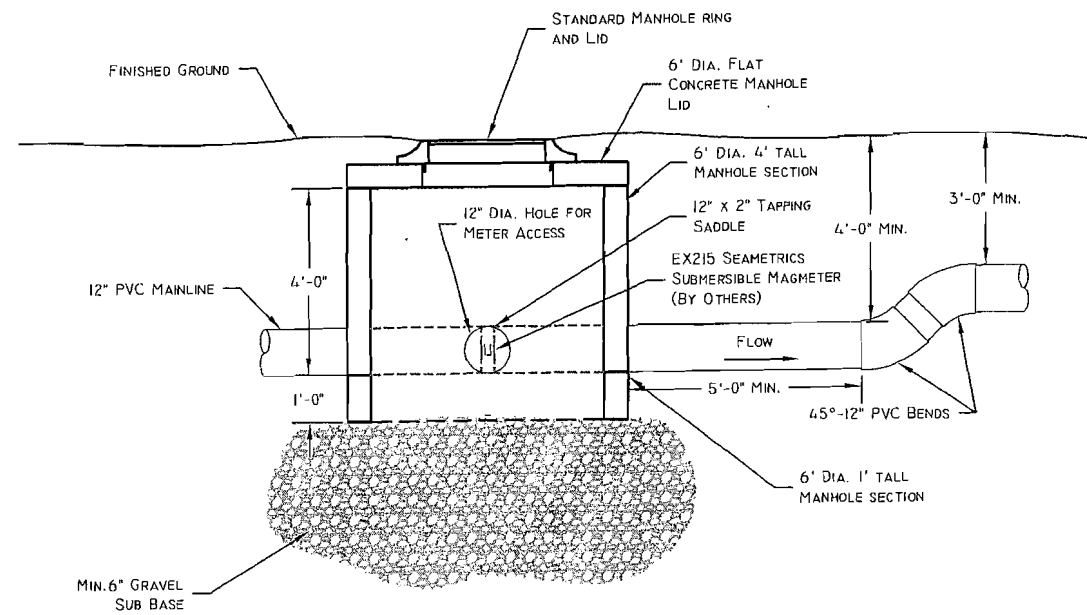


PROJECT LEADER:		PROJECT DATE:	
L. WAYNE JENSEN		SEP. 02, 2009	
DESIGNER:		REVISIONS	
DRAFTSMAN: MATT GUNN		NO. DATE INTS. DESCRIPTION	
		1 JUL 2009 13 RESPOND TO BUREAU OF RECLAMATION COMMENTS	

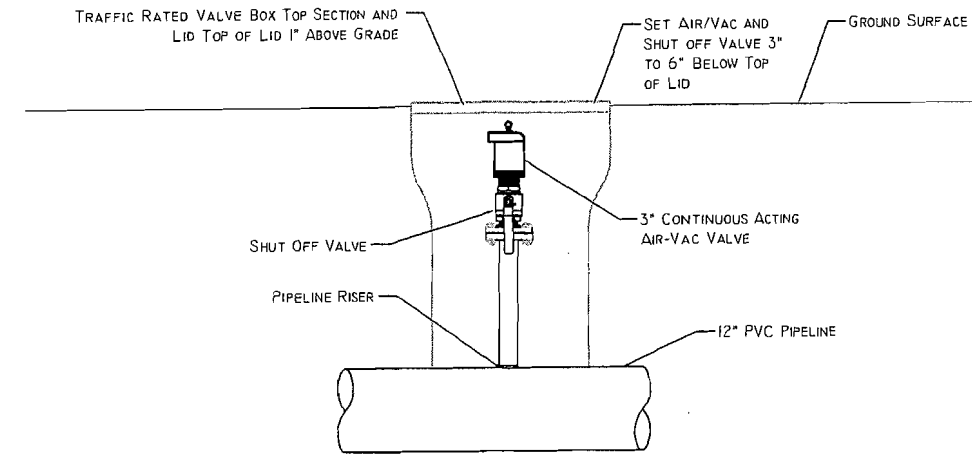
VOLTA WASTEWATER RECLAMATION PROJECT
FENCE & THRUST BLOCK DETAILS
Fence Details.dwg
H:\CLIENTS\USBR\Area1-3\46 IDIU Contract\5-Project\Volta\PROJECT\1-4
Drawings
LAYOUT: Details
JOB NO.
CA 000000



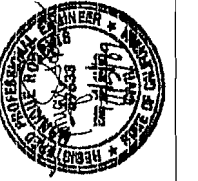
12 METER MANHOLE DETAIL
SCALE: 1" = 4'



Q METER MANHOLE SECTION
SCALE: 1" = 4'



13 AIR/VAC DETAIL
NTS



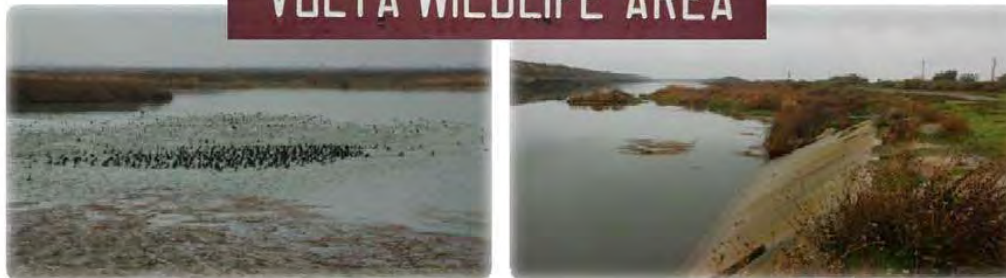
DESIGNER	CHECKED	PROJECT LEADER	MIN. DATE	REVISIONS	DESCRIPTION
DESIGNER: VIKER MOORE	CHECKED: RYAN WILK	PROJECT LEADER: LAYNE JENSEN	MIN. DATE: SEP 02 2009		
DRAFTSMAN: MATT GIER					
DATE: JUL 2009					
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1					
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Appendix C Monitoring Plan



PROJECT MONITORING PLAN

DEPARTMENT OF FISH AND GAME
VOLTA WILDLIFE AREA



MARCH 2010

VOLTA WILDLIFE AREA
LEVEL 2 DIVERSIFICATION/
INCREMENTAL
LEVEL 4 DEVELOPMENT
PILOT PROJECT

1. Introduction

The Central Valley Project Improvement Act (CVPIA) of 1992 requires that the Department of the Interior acquire additional water supplies to meet optimal waterfowl and wildlife habitat management needs on refuges within California's Central Valley. These refuges collectively encompass National Wildlife Refuges, State Wildlife Management Areas and the Grassland Resource Conservation District (GRCD). The Bureau of Reclamation (Reclamation) is acting on behalf of the Department of Interior to fulfill these requirements.

Specific water management goals have been determined for two independent water supply levels termed Level 2 and Level 4. Level 2 refuge water refers to the average amount of water the refuges received between 1977 and 1984. Level 4 water is the amount of water required for full development of the refuges based upon the management goals of individual refuges and wildlife areas, consistent with CVPIA 3406(d)1 and (d)2. Incremental Level 4 water is the difference between full Level 4 and Level 2 water supply. Level 2 refuge water is normally utilized between September 1st and March 15th where as the Level 4 supply is used for summer brood habitat maintenance and spring/summer irrigations. In order to meet goals associated the CVPIA, Reclamation desires to increase the use of alternative refuge water supply sources by diversifying Level 2 refuge water supplies while increasing local sources of Incremental Level 4 refuge water supply. The Volta Wasteway Level 2 Diversification/Incremental Level 4 Development Pilot Project (Pilot Project) is a three-year demonstration project to evaluate the feasibility of groundwater utilization to diversify a portion of Level 2 supply and to supplement Incremental Level 4 supplies to wildlife refuges within California's San Joaquin (SJ) Valley.

Wetlands in the Central Valley are intensively managed to produce standing crops of plants and invertebrates with high value to wildlife. An effective method of wildlife food production is moist soil management. Moist soil management includes the timing of hydro-periods to optimize germination and plant growth. Grassland Water District (GWD) is responsible for the annual delivery of over 180,000 acre feet (AF) of water to seasonal and semi-permanent federal, state and private wetlands within the GRCD. The 180,000 AF of water that the GWD is responsible for delivering is composed of 125,000 AF of Level 2 supply, and 55,000 AF of Level 4 supply. In 13 of 14 years, Reclamation has been unable to provide the 55,000 AF of Incremental Level 4 water deliveries annually, as required by the CVPIA of 1992. In 2008 and 2009 the GWD received less than 24% of its obligated Level 4 surface water supply. Level 4 water supplies are critical for the optimization of seed and biomass production, the health and survival of locally breeding shorebirds and waterfowl, the state and federally threatened Giant Garter Snake (GGS) and the productivity of the largest of California's remaining wetlands.

The Pilot Project proposes the installation of two deep groundwater wells to develop up to 5,000 AF/year of new CVPIA Level 2 and Incremental Level 4 water supplies. The additional water developed through this Pilot Project would augment south of Delta shortages to the wetlands by annually supplying up to 2,500 AF of Level 2 and up to 2,500 AF of Incremental Level 4 supplies. Agricultural contractors would benefit by receiving up to 2,500 AF of Central Valley Project surface water annually made available by the groundwater pumping at Volta Wildlife Management Area (WMA).

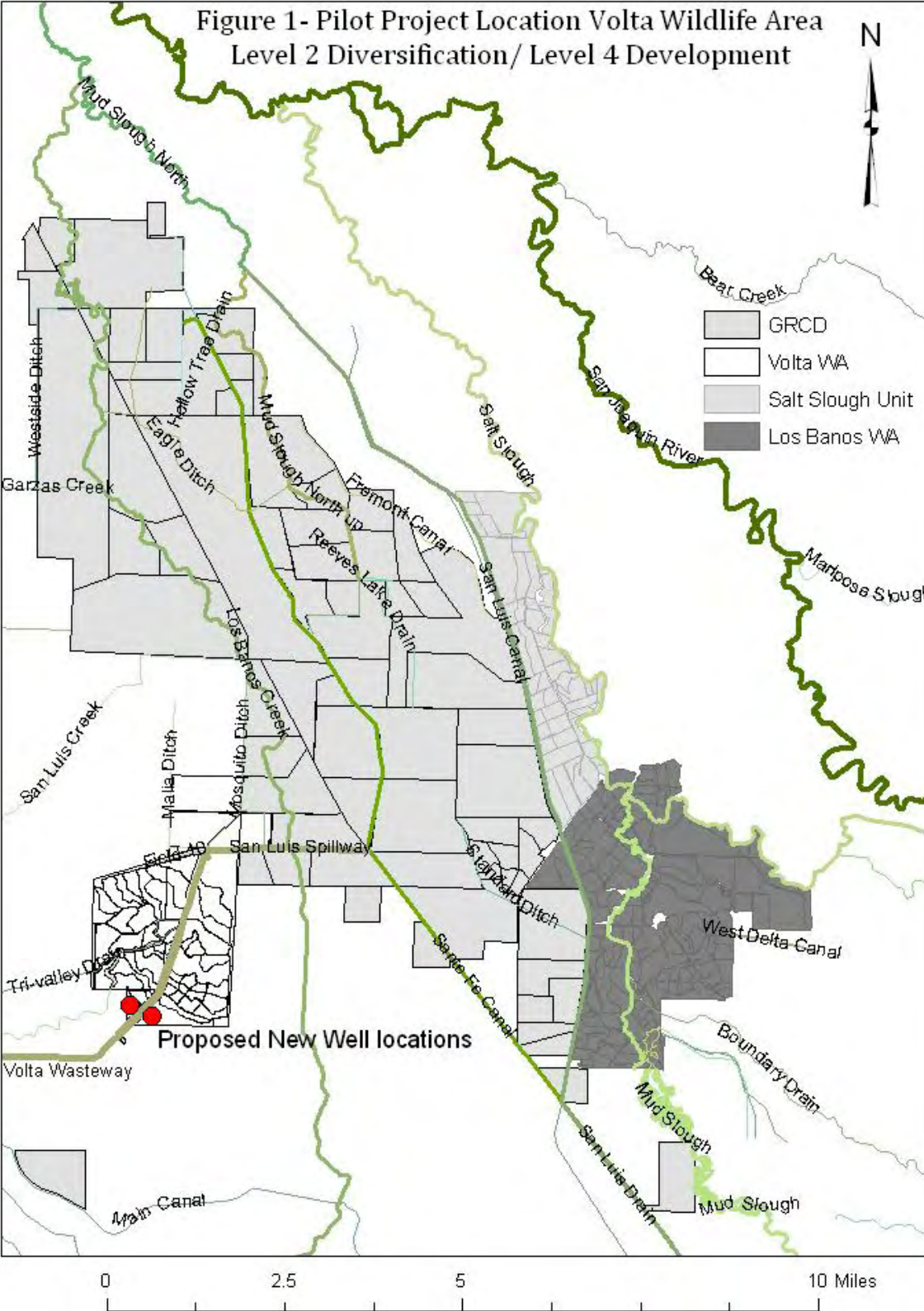
Project Setting

The Volta Wasteway is located approximately six miles northwest of Los Banos in western Merced County (Figure 1). The Volta WMA is owned by Reclamation and has been operated by the California Department of Fish and Game (CDFG) since 1952 under a lease agreement. The Volta Wasteway is the primary supply canal for the Northern Division of the GRCD. Water is released from the Delta Mendota Canal (DMC) to the Wasteway through a variety of control structures for distribution throughout the Northern GRCD. The Wasteway conveys flows directly to the Volta WMA through lift pumps, and to the GRCD through releases out of control structures located in Pond 10¹. Pond 10 structures are located at the terminus of the Wasteway and directly feed into the Santa Fe Canal Cross Channel, Mosquito Ditch and Malia Ditch. Wetlands in this region are typically flooded in late August to early September with flows in the Wasteway reaching 450 cubic feet per second (cfs). Wetland water elevations are maintained throughout the GRCD with maintenance flows from late October through the winter months to provide foraging and loafing habitat for waterfowl, shorebirds and other species. During the fall and winter maintenance flow periods, the Wasteway experiences flows up to 100 cfs. In the spring when soil temperatures are optimal for seed germination and successive plant growth, the wetlands are drained. Waters drained from these wetlands are conveyed to Mud Slough and Los Banos Creek which ultimately discharge to the San Joaquin River. Beginning in late April and continuing through the summer months, irrigation flows are delivered to the wetlands, filled and subsequently drained. During these periods the Wasteway can experience flows up to 150 cfs.

Project Objectives

The objectives of this Pilot Project are to: (1) develop a long-term groundwater supply that can be used to diversify CVP water supply sources and improve water supply reliability for CVP contractors, as well as supplementing Incremental Level 4 supplies for the SJ Valley Refuges, and (2) to confirm that the groundwater quality is acceptable for refuge use. Reclamation's goal is to pump up to 2,000 AF between September 1, 2010 and February 28, 2011 in year one, potentially producing up to 5,000 AF of groundwater per year (2011-2013) from this Pilot Project. Two production wells are to be installed and operated at maximum capacity (target of approximately 1,500 gpm per well) for three years. If target maximum capacity of 1,500 gpm per well is achieved, the two wells will produce 2,000 AF in 151 days of operation. Production well operation, timing and duration will be determined by Reclamation in coordination with GWD and CDFG based on water demand and both well and surface water quality. If the well operational goal of September 1, 2010 is achieved, as well as the target maximum capacity of 1,500 gpm, pumping could occur through January 29, 2011 but no later than February 28, 2011 in year one. In years two and three, Reclamation's goal is to pump up to 5,000 AF. The project water will be supplied to south of Delta refuges that are entitled to receive CVP water pursuant to Section 3406(d) of the CVPIA, show a demonstrated need or shortfall, and can receive the water by direct delivery from the Volta Wasteway.

¹ Pond 10 and Field 10 are used interchangeably throughout this document.



Project Viability

The key elements of project viability are the sustainable yield of the two new production wells to be screened below the Corcoran Clay and the quality of the water ascertained. Surface water and production well water quality monitoring will determine if and when adequate surface water dilution is available to meet State Water Resource Control Board's (SWRCB) water quality objectives outlined in the Central Valley Basin Plan and determine timing of well usage. This Project Monitoring Plan describes the data to be collected during the three-year demonstration period to address the project objectives and assess the long-term viability of the project.

2. Hydrogeologic Setting

The Volta WMA is located in the Merced sub-basin of the San Joaquin Valley basin. Groundwater supplies are present in unconsolidated deposits extending to 900 feet or more below grade. An upper, semi-confined aquifer extends from approximately 50 feet to 250 feet below grade. The Corcoran Clay, a regional aquitard that acts as a semi-confining unit, separates the upper semi-confined aquifer from deeper alluvial deposits, which form the lower confined aquifer. In the project area, the Corcoran Clay is found at approximately 250 feet to 450 feet below ground surface (bgs).

Wells screened in the semi-confined aquifer above the Corcoran Clay are likely to be in hydraulic communication with overlying surface water features, such as the Volta Wasteway and wetlands areas in the Volta WMA. Wells screened in the lower confined aquifer are not as likely to be in communication with surface water resources. Due to the potential mixing of waters between the two aquifer units, the Merced County Environmental Health Department (MCEHD) prohibits the construction of wells that are open to both aquifers within the same borehole.

Aquifer Yields

High-capacity wells screened in the lower confined aquifer in the vicinity of the Volta WMA reportedly yield from 1,000 to 1,500 gpm and as high as 2,000 gpm. Well yields are known to vary considerably in this area.

Groundwater Quality

The groundwater quality within the Merced sub-basin varies with location and depth both within the upper semi-confined and lower confined aquifers. In the lower confined aquifer, total dissolved solids (TDS) concentrations generally range from 100 to 3,600 milligrams per liter (mg/L). In two test holes drilled in the Volta WMA, TDS ranged from 300 mg/L (near the southern property boundary in close proximity to the proposed well locations) to over 1,500 mg/L (near the northern property boundary approximately 3 miles from proposed well locations). Wells operated by a local food processing plant yield groundwater from the lower confined aquifer with TDS concentrations ranging from 570 mg/L to 2,000 mg/L and electrical conductivity measurements ranging from 1,000 to 3,400 micro-Siemens (µS). Based on this limited data, and discussions with local drillers familiar with the area, it is evident that the water quality of the lower confined aquifer is variable throughout the Merced sub-basin.

According to MCEHD and the California Regional Water Quality Control Board, Central Valley Region (CRWQCB-SJR), constituents other than TDS that can affect water quality in the area include dissolved metals and nutrients.

3. Project Monitoring Plan Objectives

To meet the overall project objectives, this Project Monitoring Plan has the following objectives: (1) identify the data to be collected during the three-year Pilot Project to evaluate the overall project objectives; (2) specify the data collection procedures; and (3) clarify the responsibilities for data collection and interpretation for implementation of the Project Monitoring Plan. The information collected, interpreted, and reported in this monitoring program will address the project objectives for this Pilot Project.

There are four primary components that will be monitored as part of this program. These components are as follows:

- Hydrogeology – groundwater supply issues associated with the extraction and discharge of groundwater to the Volta Wasteway. This Project Monitoring Plan specifies the data to be collected to evaluate (1) the performance of the two new wells (i.e., well efficiency and long-term yield), (2) the affect the wells have on the surrounding area (i.e., radius of influence and potential interference between the two wells), and (3) whether there is any potential interconnection across the Corcoran Clay between the upper semi-confined and lower confined aquifers as well as within vertically separated water-bearing zones within the upper semi-confined aquifer.
- Water Quality – both ambient groundwater quality in the upper semi-confined and lower confined aquifers and potential changes to surface water quality in the Volta Wasteway due to the discharge of groundwater. This Project Monitoring Plan provides procedures for collecting and analyzing groundwater samples for a range of constituents to initially characterize and then monitor water quality during the three-year demonstration period.
- Biological – A collaborative research project, “Implementation of Priority 1, Priority 2, and Priority 3 Recovery Tasks for Giant Garter Snake (*Thamnophis gigas*) – Wetland Habitat Restoration and Giant Garter Snake Population Monitoring on the San Joaquin Valley’s Volta Wildlife Area, Merced, CA”, is being developed to better understand habitat requirements of the Giant Garter Snake (GGS).
- Ground Subsidence – the potential lowering of the ground surface elevation due to the removal of groundwater from beneath the Corcoran Clay. Subsidence monitoring procedures will be developed by Reclamation in consultation with the U.S. Geological Survey (USGS).

4. Implementation Responsibilities

The overall implementation of this Project Monitoring Plan is the responsibility of Reclamation. The specific responsibilities for implementation of the four main components noted previously are as follows:

- Hydrogeology – Each Volta well will have a cluster of monitoring wells that will be outfitted with vented pressure transducers permanently connected to a data logger and tethered EC probes with on board logging. The GWD Water Quality Monitoring Plan (WQMP) will be responsible for the collection and transmission of data to Reclamation (specifically a technical consultant from Lawrence Berkeley National Laboratory under contract to Reclamation; Reclamation contractor). The Reclamation contractor will be responsible for the interpretation, and reporting of the hydrogeologic data. The GWD WQMP will be supported by Reclamation for the collection of water level, groundwater pumping (i.e., pumping rate and total volume), and electricity use data.
- Water Quality – the GWD WQMP and Reclamation (specifically the Reclamation contractor) will share the responsibility for implementation of this component. The GWD WQMP will be responsible for the collection, storage and transmission of EC, Flow, and grab sample water quality data to the Reclamation contractor. The Reclamation contractor will be responsible for the interpretation and reporting of discrete groundwater and surface water quality data. The Reclamation contractor will be responsible for the selection of monitoring equipment to measure and log groundwater extraction rates of the water at the production wells. Each well will be outfitted with a digital output totalizing flow meter and a data logger to insure the preservation of data. The GWD WQMP will continue to be responsible for the collection, storage and transmission of data from the existing real time surface water monitoring station located downstream of Field 26. Reclamation will be responsible for the purchase of equipment at each production well. The GWD (with assistance of the Reclamation contractor for troubleshooting) will be responsible the installation and maintenance of the instrumentation for the monitoring stations at each production well.
- Biological - “Implementation of Priority 1, Priority 2, and Priority 3 Recovery Tasks for Giant Garter Snake (*Thamnophis gigas*) – Wetland Habitat Restoration and Giant Garter Snake Population Monitoring on the San Joaquin Valley’s Volta Wildlife Area, Merced, California” (Proposed Study). This Proposed Study is currently being considered for FY2010 funding under the authority of either the Central Valley Project (CVP) Conservation Program or the Central Valley Project Improvement Act (CVPIA) Habitat Restoration Program administered by United States Fish and Wildlife Service (USFWS) and Reclamation. The Proposed Study would gather data to better understand habitat requirements and utilization by GGS, which includes water quality monitoring, within the Volta WMA. If funding for the Proposed Study is approved, Reclamation would use the Proposed Study to meet any biological monitoring requirements for the Volta Wildlife Area Level 2 Diversification/Incremental Level 4 Development Pilot Project.
- Ground Subsidence – Reclamation (specifically the Reclamation contractor) will be responsible for coordinating with the USGS for the collection, interpretation, and reporting of ground subsidence data in the Volta WMA.

GWD will be responsible for maintaining the project water quality database, conducting initial quality assurance and quality control reviews of the data, and producing data transmittal reports to the Reclamation contractor and Reclamation. The Reclamation contractor will assist GWD with improvements to data management procedures over the project term. The GWD WQMP, with the assistance of the Reclamation contractor, will produce a final evaluation report, which will be delivered to Reclamation following completion of the demonstration project.

5. Scope of Work

The Pilot Project will be assessed by collecting hydrogeologic, water quality, biological, and subsidence data within the Volta Wasteway and at the Volta WMA, as described below.

Hydrogeology

Two water production wells are to be installed and operated at maximum capacity (target of approximately 1,500 gpm per well) for three years. If target maximum capacity of 1,500 gpm per well is achieved, the two wells will produce 2,000 AF in 151 days of operation. Production well operation, timing and duration will be determined by Reclamation in coordination with GWD and CDFG based on water demand, well and surface water quality, and habitat quality. Prior to the initiation of pumping in year one, baseline depth to water measurements will be taken manually using an electronic water level indicator in the two production wells. During the first month of operation, continuous hourly depth to water measurements will be taken in the two production wells. The GWD WQMP will also collect manual Quality Assurance (QA) depth to water measurements using an electronic water level indicator on a daily basis within the first week of operation, weekly within the first month of operation, and monthly during the operation period. Each well will have a cluster of monitoring wells that will be outfitted with vented pressure transducers permanently connected to a data logger and a tethered EC probe with on board logging. Continuous (hourly) data will be collected at the five Volta monitoring wells (2 clusters of wells; shallow semi-confined, deep semi-confined and sub-Corcoran). Monitoring well EC data will be downloaded on a monthly basis from the tethered probes. During the year one operation period (September 1, 2010-February 28, 2011), the GWD WQMP will collect continuous flow measurements (flow rates and totalizer digital output to data logger) from the two production wells. Hourly rainfall and evaporation pan data will be collected at a site closest to the production wells. Reclamation will obtain electricity use information throughout the operation period in bills received directly.

Water Quality

The GWD WQMP will collect baseline and interim water quality samples from the two production wells and five monitoring wells and submit them to an analytical laboratory for analysis. Water quality data from the monitoring wells will be coordinated to the extent possible with the USGS which has sampling equipment that will allow baseline water quality data to be collected. The baseline sampling event will occur prior to the initial start-up of the production wells and upon completion of the adjacent monitoring wells at the Volta site in conjunction with USGS. The baseline and interim sample collection and subsequent analysis of well discharge and surface water constituent concentrations will determine the minimum surface water volume required for adequate dilution of trace elements below SWRCB water quality objectives outlined in the Central Valley Basin Plan:

- **Selenium < 2.0 (µg/l),**
- **Boron < 2.0 (mg/l) March 15 – September 15,**

- **Boron < 2.6 (mg/l) September 16 – March 14,**

If inadequate dilution flows are available, GWD will cease the operation of the well until adequate dilution flow conditions return. The GWD WQMP will collect interim water quality samples from the two production wells throughout the duration of the project, following the schedule described below.

The analytical laboratory will analyze the baseline water quality samples for the following constituents:

- General minerals (anions, cations)
- Nitrate
- TDS & EC
- Trace Elements (Selenium, Boron, Arsenic, Uranium, Mercury)

Interim surface and production well water quality samples will be analyzed for general minerals, nutrients and TDS, unless the baseline sampling event indicates that metals or organics are of potential concern.

The GWD WQMP will collect water quality samples from the production wells on a monthly basis and from the Volta Wasteway on a weekly basis, immediately upstream and downstream of the production well discharge points. Water quality samples will be submitted to an analytical laboratory for the analyses described above during year one at which time an assessment of required sample frequency will occur based on the variability of the surface and ground water trace element concentration. Pumping will occur during any duration that well water quality is found to have a lower EC and lower trace element(s) concentration than the surface water quality being discharge into.

Volta Wildlife Area Level 2 Diversification/Incremental Level 4 Development Pilot Project-Monitoring Plan - Surface Water Quality Degradation Avoidance Protocol

A Surface Water Quality Degradation Avoidance Protocol (SWQDAP) has been developed by the Grassland Water District (GWD), CDFG, the SLDMWA, and the Reclamation for the Volta Wasteway related to the operation of two deep wells located within the Volta WMA under the Pilot Project.

Surface water quality (EC - Electro-Conductivity $\mu\text{S}/\text{cm}$) in the Volta Wasteway is seasonally variable ranging from 389 $\mu\text{S}/\text{cm}$ (observed in September of 2006), to 2460 $\mu\text{S}/\text{cm}$ (observed in August of 2007). To account for this high variability in seasonal water quality a SWQDAP was developed to preserve periods of relatively good water quality (seasonally low EC) that a static trigger would otherwise evade (See Figure 3.0). The SWQDAP is based on historical weekly EC data collected by the CDFG from April of 2005 through December of 2009 using a calibrated Myron ULTRAMETER 6P. Summary statistics including the Monthly Average EC and SE (Standard Error) is the foundation for the development of the SWQDAP (See Appendix C, Figures 1.0 and 2.0).

The Max EC 2005-2009 heading in the attached Figure 2.0 (Appendix C) is the Maximum Observed Monthly Average EC from 2005-2009 and is the Caution Threshold where pumping would proceed with caution. The SE heading in Figure 2.0 (Appendix C) is the corresponding SE from the Max Observed Monthly Average EC 2005-2009. The MAX EC + SE 2005-2009 heading in Figure 2.0 (Appendix C) is the sum of the MAX EC and corresponding SE and is the STOP THRESHOLD and determines when pumps will be shut off, effectively avoiding the elevation of salt beyond recent historical salt conditions observed due to the pumping associated with this pilot project (See Appendix C, Figure 4.0).

Production well operation, timing and duration will be determined by GWD in coordination with CDFG based on water demand and both well and surface water quality in the Volta Wasteway and receiving wetland habitat. During well operation weekly EC grab sample data as well as continuous real time EC data will be collected downstream of the discharge points of the two production wells at the CDFG Volta Bridge grab sample data collection point. Analysis of the EC data will occur on a weekly basis and assess the Average EC of the previous four week period to determine the operation or non-operation of the two production wells in the week to come (See Figure 5.0). If the four week running average EC is below the Monthly MAX EC STOP threshold for the operational period in question pumping will occur. If the four week running average EC is above the Monthly Max EC threshold for the operational period in question pumping will not occur. A conditional real time EC data analysis will occur if the 4 week running average EC enters the caution threshold. This conditional real time EC data analysis will occur on the scheduled weekly interval but will analyze continuous 15 minute EC data to characterize variability in EC that may not be represented in the weekly grab sample EC data. A conditional real time EC data analysis will also occur if the 4 week running average EC enters the STOP threshold. This conditional real time EC data analysis will occur on a bi-daily basis and will analyze continuous 15 minute EC data to characterize variability in EC that may not be represented in the weekly grab sample EC data and enhances the responsiveness of the operations associated with the STOP threshold (See Figure 6.0).

The SWQDAP was developed by the analysis of historic grab sample EC data collected in proximity to the proposed project location. This method should not be applied to any other conveyance system. Data utilized in the same manner must encompass a full wet-dry cycle to accurately represent annual variability in water quality and undergo a rigorous quality assurance protocol to insure that the data is representative of surface water quality conditions. The SWQDAP is a method to minimize surface water quality degradation specifically for this Pilot Project.

The Reclamation contractor will provide oversight for the collection of water quality data from the two production and six monitoring wells continuously logged on an hourly basis (EC and temperature). The GWD WQMP will also collect downstream surface water quality data (EC, Temp, and Flow) from the real time monitoring station currently in use in the Volta Wasteway. Data will be stored in a database and transmitted monthly by e-mail to the Reclamation contractor.

Biological Monitoring

Reclamation, in conjunction with CDFG, will develop a biological monitoring program to collect appropriate physical and biological data in the project area for GGS.

Ground Subsidence

The Reclamation contractor will coordinate with the USGS to collect ground surface elevation data (INSAR time-series data) in the vicinity of the two production wells to assess the potential for land subsidence due to groundwater extraction. A schedule for collection of the subsidence data will be determined. Reclamation will provide USGS data to the Authority, GWD WQMP and CDFG for their evaluation.

6. Field Data and Sample Collection

The various team members will strive to minimize hand-entered data and provide electronic data that can be efficiently entered into project database housed at the GWD in a timely fashion. Electronic forms will be developed and used to collect basic site information at each site visit. Data quality assurance checks will also be entered into the project database. This database will be backed up and shared with the Reclamation contractor monthly or an as needed basis. The GWD WQMP will record hydrogeologic and well sampling information on project-specific electronic field logs, included in Appendices A and B. These data will also be entered into the project database.

Hydrogeology

Monitoring wells will be outfitted with vented pressure transducers and the data reported to a data logger (logged hourly) installed adjacent to each well. Monitoring wells will also be outfitted with tethered EC probes with on board logging and down loaded on a monthly basis. The GWD WQMP will collect manual QA depth to water measurements using an electronic water level indicator on a daily basis within the first week of operation, weekly within the first month of operation, and monthly during the operation period. The GWD WQMP will all collect depth to water measurements, no less than 24 hours after the onset of operation and no less than 24 hours after the end of the operational period, to characterize ground water recovery and residual drawdown of the two production wells. Each production well will be outfitted with a totalizing flow meter, solar powered data logger and security enclosure. Flow data will be logged continuously on an hourly basis. Prior to collecting the water level measurements from each production well during the pumping season, the flow rate, total flow, and electric meter reading will be recorded in the electronic field log. The procedure for groundwater level measurement and the project field log form can be found in Appendix A. If early monitoring events indicate greater variability than expected, additional monitoring events may be added.

Water Quality

The GWD WQMP will collect water samples for laboratory analysis from the two production wells on a monthly basis, and the Volta Wasteway (2 locations - upstream and downstream of production well discharge points) prior to the first day of pumping (baseline sampling event) and weekly during the pumping duration. At the end of the year one pumping period an assessment of required sample frequency will occur based on the variability of the surface and ground water trace element concentration. If there is little change, water quality sampling will be performed semi-annually. During year two of the demonstration project, the GWD WQMP will collect water quality samples from the two production wells and the Volta Wasteway (2 locations) in October and May unless data from year one reveals high variability in constituent analysis. However, if early monitoring events indicate greater variability than expected, additional monitoring events may be added. The intent of the water quality program is that it be adaptive – that it adequately characterizes ambient water quality in the groundwater and transients in water quality with the onset of groundwater pumping. Sampling procedures are briefly described below. A detailed description of the sampling procedures, monitoring well purging requirements and a project field log form are included in Appendix B.

- Production Well Sampling- Baseline production well grab sampling will be conducted in conjunction with USGS during the installation of each well. Interim, monthly water samples from the two production wells will be collected using the sample tap installed at each wellhead. To collect a sample, staff will open the tap and allow a minimum of 10 gallons of water to run through the tap. Once the sample tap has been purged, and clear water is being produced, staff will fill the laboratory-supplied sample bottles directly from the tap. Field water quality parameters (temperature, pH, and EC) will be measured during the sample collection process. Samples will be stored in a cooler containing ice until they are delivered to the analytical laboratory. Temperature and EC will be continuously logged on an hourly basis throughout the duration of the project.
- Monitoring Well Water Quality- Tethered EC probes will continuously log data throughout the duration of the project and will be manually downloaded on a monthly basis.
- Volta Wasteway Sampling- In year one, weekly water samples will be collected from two fixed locations in the Volta Wasteway (upstream and downstream of the groundwater discharge locations). Samples will be collected using a sample bottle connected to an extension pole. The water will then be transferred to laboratory-supplied sample bottles. Samples will be stored in a cooler containing ice until they are delivered to the analytical laboratory. Field water quality parameters will be measured during the sample collection process.

Biological Monitoring

Reclamation, in conjunction with CDFG, will be responsible for the collection, interpretation, and reporting of GGS habitat (physical and biological) information in and around the Volta Wasteway and the Volta WMA.

Land Subsidence

The USGS will collect ground surface elevation data (INSAR time-series data) in the vicinity of the two production wells in accordance with the plan to be developed by Reclamation.

Operational Information

Production well operation, timing and duration will be determined by GWD and CDFG based on water demand, well and surface water quality, and habitat quality. In year one, pumping will occur between September 1, 2010 and February 28, 2011 and will not exceed 2,000 AF. If the well operational goal of September 1, 2010 is achieved, as well as the target maximum capacity of 1,500 gpm, pumping could occur through January 29, 2011 but no later than February 28, 2011 in year one. In years two and three, Reclamation's goal is to pump up to 5,000 AF.

During sampling or monitoring events, the status of the production wells, monitoring wells, and operating equipment will be recorded in an electronic form and photo documented periodically. These data will also be entered into the project database. Broken, damaged, vandalized and/or otherwise inoperable equipment and appurtenances will be immediately reported to Reclamation by the person who observed the damage. Field records will also note any maintenance performed on the equipment.

The condition of the erosion control features will also be recorded and photo-documented during each sampling or monitoring event. As part of the habitat observations to be conducted, appropriate environmental conditions of the Volta Wasteway and the Volta WMA will be photo-documented.

7. Data Collection and Management

The GWD WQMP will collect data as described previously throughout the project duration (Table 1). Field data will be entered into a master project database and protocols developed for electronic sharing of this data. The Reclamation contractor will provide technical assistance to improve the database management system through the course of the study. Electronic data will be obtained from the analytical laboratory, the monitoring stations, the USGS INSAR database, and local weather station and this will also be entered into the master project database. Field data will include water level and field water quality measurements, well purging and sampling information, and environmental and biological observations. These data will also be entered into the master project database.

Electronic Data

Throughout the duration of the project, electronic data will be downloaded from multiple sources as described above. Each data source will have a unique set of download and data quality control procedures. The specific procedures are provided below.

- Laboratory data – will be uploaded to a data validation program to ensure completeness. Once the data has been electronically validated, the data file will be uploaded to the project-master database. A summary report will be generated and validated against the PDF file provided by the laboratory. The Reclamation contractor will be provided with copies of the validated quarterly via e-mail.
- Real Time Monitoring Station data – will be downloaded by the GWD WQMP as an ASCII text file. This data will be uploaded to a data quality validation program and adjustments made to the data to match QA checks. The QA validated data will be uploaded to the master project database and a summary report will be generated. The summary report will be provided by the GWD WQMP to the Reclamation contractor.
- USGS INSAR data – the USGS will provide both raw and interpreted INSAR data to the Reclamation contractor for dissemination to the GWD and the larger project team. Data formats will be chosen so that the data is compatible with the master project database housed at the GWD.
- Weather data – will be downloaded via the internet from a local weather station. The data will be exported to both a PDF file and an ASCII text data file and uploaded to the master project-database.

Field Data

Field notes and photographs (as applicable) will be entered into the master project database. Depth-to-water and field water quality measurements will also be entered into the database. A summary report will be generated and validated against the hard copy field data sheets. Digital images of site photographs collected throughout the project duration will be stored in the electronic database and linked to a GIS map of the project area. Backups of the master project database will be performed weekly. These data will be provided to the Reclamation contractor quarterly.

TABLE 1 - Field Data Collection Schedule & Responsibility								
	YEAR							
	1				2		3	
FIELD DATA COLLECTION	Week 1	Month 1	Operation (TBD)	Non-Op (TBD)	Operation (TBD)	Non- Op (TBD)	Operation (TBD)	Non- Op (TBD)
HYDROGEOLOGY								
Water Levels (LOGGING)	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)
Water Level (MANUAL QA)	Daily (GWD)*	Weekly (GWD)	Monthly (GWD)	(GWD)**	Monthly (GWD)	(GWD)**	Monthly (GWD)	(GWD)**
Flow Rate & Total Flow	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)	NA	Hourly (GWD)	NA	Hourly (GWD)	NA
WATER QUALITY								
Production & Monitoring Wells (EC)	Hourly (GWD)	Hourly (GWD)	Hourly (GWD)	NA	Hourly (GWD)	NA	Hourly (GWD)	NA
Production Wells (LAB ANALYSIS)	B* (GWD)	(GWD)	Monthly (GWD)	NA	FALL SPRING (GWD)	NA	FALL SPRING (GWD)	NA
Surface Water (EC) Up/ Down Stream	Daily (GWD)	Weekly (GWD)	Weekly (GWD)	NA	Weekly (GWD)	NA	Weekly (GWD)	NA
Surface Water (LAB ANALYSIS)	B* (GWD)	Weekly (GWD)	Weekly (GWD)	NA	FALL SPRING (GWD)	NA	FALL SPRING (GWD)	NA
BIOLOGICAL	TBD (Reclamation)				TBD (Reclamation)		TBD (Reclamation)	
SUBSIDENCE	USGS -Reclamation (LBNL)				USGS -Reclamation (LBNL)		USGS -Reclamation (LBNL)	
Week 1/ Month 1 represents the first week/ month of well (operation goal September 2010) Operation Period- Up to 12 Months (TBD), Non Op (Operation) period TBD (to be determined) Hydrogeology- Water Levels (Production & Monitoring well depth to water- Continuous logged hourly) Hydrogeology- Water Levels (Manual QA) Production & Monitoring well using a EWL Hydrogeology- (GWD)* = Groundwater Recovery & Residual Drawdown (≥24 hrs after pumping has STARTED) Hydrogeology- (GWD)** = Groundwater Recovery & Residual Drawdown (≥24 hrs after pumping has FINISHED) Hydrogeology - Flow Rate & Total Flow -Continuous logged hourly B* = Baseline Data Collection- GWD WQMP will collect samples prior to initiation of pumping in year 1 Water Quality- Production & Monitoring Well EC- Continuous (hourly) logging Water Quality – Production Well Lab Analysis (Monthly in Year 1, semi-annual (Fall/ Spring) in years 2 & 3) Water Quality- Surface Water Lab Analysis (Weekly in Year 1, semi-annual (Fall/ Spring) in years 2 & 3)								

8. Reporting

The schedule for implementing the Project Monitoring Plan is based on the assumption that the two production wells and five monitoring wells will be constructed and operational by August 2010, with the first month of operation September 2010. The GWD WQMP, with the assistance of the Reclamation contractor, will submit annual reports to Reclamation and CDFG in March 2011 and March 2012 following the completion of pumping in January of each year. The final project evaluation report, which will transmit all project data and provide an evaluation of the three-year demonstration project, will be submitted to Reclamation, USFWS and CDFG in April 2013, following completion of the monitoring program.

Data transmittal reports will include a brief description of the activities conducted during the previous pumping season, and a summary of the data collected. The data transmittal reports will also identify work that deviated from the planned activities, and provide an explanation for the deviation. A summary of the activities to be conducted during the subsequent year will also be provided.

The final report to be delivered to Reclamation, USFWS and CDFG will summarize the data collected throughout the duration of the demonstration project and provide evaluations of the various physical and environmental parameters monitored. Hydrogeologic data will be used to evaluate the specific capacity and long-term yield of the two production wells; estimate radius of influence and pumping interferences of the two production wells; and provide an assessment of the interconnection between surface water and the upper and lower aquifers, if any. Any measureable land subsidence, due to the pumping of groundwater from the lower aquifer, will also be reported.

Water quality data, including EC, temperature and dissolved metals concentrations, will be summarized and evaluated relative to any noticeable changes in the habitat documented by Reclamation over the duration of the demonstration project.

9. Program Schedule

The three-year monitoring program will begin in September 2010 and will be completed by January 2013. The schedule for field sampling and data collection events is described above and summarized in Table 1. The Reclamation contractor will submit annual reports in March 2011 and March 2012, and the final report in April 2013.

Prior to the installation and development of the production wells, Reclamation will provide contractors, CDFG and other government agencies involved in the monitoring program a copy of the monitoring plan and initial monitoring program schedule. Reclamation will keep these parties apprised of any changes to the sampling schedule or project scope.

APPENDIX A

Procedure for Groundwater Level Measurement

Purpose/Application

The objective of these guidelines is to provide general reference information and technical guidance on the measurement of the depth to groundwater in an open borehole, cased borehole, monitoring well, or piezometer.

Method Summary

When measuring groundwater levels, there should be a clearly established reference point of known elevation, which is normally the top of the well casing. The reference point should be scored or permanently marked on the rim of the casing if the casing rim is not even and level. To be useful, the reference point should be tied to a USGS benchmark or a local datum. The field notes recorded should clearly describe the reference used. An arbitrary datum could be used for an isolated group of wells if necessary.

Before measurements are made within the production well casing - water levels should be allowed to stabilize for a minimum of 24 hours after well construction and development. In low-yield conditions, recovery of water levels to equilibrium may take longer. Groundwater levels should be measured and recorded to the nearest 0.1 foot. Water level measuring equipment must be decontaminated prior to and between each use. Water level readings from adjacent monitoring wells do not require that the production well be turned off. Pressure transducers placed within monitoring wells should be withdrawn periodically for cleaning and maintenance (especially when deployed in highly saline aquifers).

The condition of the wells, piezometers, or boreholes should be recorded along with the name of the individual who has measured the groundwater levels. The frequency of such measurements should be pre-established.

Limitations

These guidelines give overall technical guidance only and should be modified as necessary based upon specified requirements of project-specific plans, site conditions, or equipment limitations. Agency protocols, such as those established by the USGS, can also be substituted for these guidelines given the anticipated collaboration with the USGS on this project.

Definitions

- Water table- The surface in an unconfined aquifer where groundwater pressure is equal to atmospheric pressure.
- Potentiometric (or piezometric) surface. An imaginary surface representing the total head of groundwater in an aquifer that is defined as the level to which water would rise in a well screened at and/or beneath the water bearing zone. The water table is a particular potentiometric surface.

Equipment

- Electronic Water Level Indicator with an accuracy of 0.1 foot or a pressure transducer selected for optimal sensitivity within the appropriate hydrostatic head range (this is typically in the range of 0 -50 ft for most monitoring well applications).
- Field notebook or data logger compatible with pressure transducer selected (battery powered transducers typically use a SDI-12 or 4-20 mA sensor interface).
- Decontamination materials (deionized water and bleach or equivalent).

An electronic water level indicator consists of a spool of graduated, small-diameter cable and a probe attached to the end. When the probe comes into contact with water, the circuit is closed and a meter, light, and/or buzzer attached to the spool will signal the contact. Nine-volt batteries are typically used for a power source. Pressure transducers contain miniature strain-gauge sensors that measure changes in electrical resistance and convert these measurements into digital signals within the solid state circuitry of the instrument. These transducers can be deployed autonomously, whereby the data is downloaded from the instrument periodically through a portable interface or continuously in cases where the instrument reports to a data logger and data is downloaded directly or via telemetry from the data logger.

Procedures

The quality assurance procedures for measuring groundwater levels are as follows:

1. Check operation of equipment.
2. Clean all equipment entering the well by washing with an Alconox solution followed by a deionized water rinse.
3. Remove well cap, note well ID, time of day and date in site logbook or an appropriate groundwater level data form.
4. Ensure well is at equilibrium with atmospheric pressure. In wells with air tight plugs, or without vents, the hydraulic head may not be the same as in an open or vented well. Allow sufficient time for the well to equilibrate to atmospheric pressure. Several measurements may be needed to verify if equilibrium has been reached. This is especially important for wells screened in confined aquifers.
5. The probe should be lowered slowly into the well and once the buzzer sounds, slowly raised and lowered until the depth where the meter first creates a sound is determined. At this point, the depth to water is read directly from the graduated cable at the reference point, and recorded to the nearest 0.1 feet.
6. Pressure transducers that are either deployed autonomously or hard-wired to a data logger will collect hourly hydrostatic head measurements. Data will be downloaded at regular intervals. A barometric probe will be required if the pressure transducer probes are non-vented.

Potential Problems/Troubleshooting

When there is high or low specific conductance, groundwater cascading in the well, or a turbulent water surface in the well, measuring groundwater levels with an electronic sounder may be difficult. Before lowering the probe into the well, the circuitry can be checked by dipping the probe in water and observing the indicator. These issues are not of concern with pressure transducer sensors. However continuous sensors can drift over time and need to be checked against well soundings at least quarterly to ensure data quality. In highly saline environments even stainless steel jacketed sensors can corrode over time. Titanium instrument casings should be chosen where possible in these situations if not cost-prohibitive.

References

Fetter, C.W., 1994, Applied Hydrogeology, Third Edition, Prentice Hall Inc., pp. 691.

United States Environmental Protection Agency (USEPA) 2000, USEPA Environmental Response Team Standard Operating Procedures, Manual Water Level Measurements.

Appendix A-2

Record Form for Groundwater Level Measurement

Groundwater Level Record Form

PROJECT NAME:

PROJECT LOCATION:

PROJECT NUMBER:

DATE:

SAMPLER(S):

Well ID

Date

Depth to Water

Well Condition

Production Well 1			
Production Well 2			
MW-1			
MW-2			
MW-3			
MW-4			
MW-5			

PHOTO TAKEN

YES

NO

Photo Number:

COMMENTS:

APPENDIX B

Procedure for Groundwater Sampling

Purpose/Application

This groundwater purging and sampling procedure presents a standard method for collecting groundwater samples from production and monitoring wells that are representative of the formation from which they are being withdrawn. USGS standard protocols will be substituted where groundwater sampling is conducted in collaboration with USGS field personnel who have customized equipment and associated field techniques for collecting water quality samples.

Equipment

Production well sampling requires the following equipment:

- Flow measurement device (instantaneous and totalizing flow meter)
- Water level probe or pressure transducer
- 5-gallon bucket
- Multi-parameter water quality monitoring system

Pre-Sampling Procedures

The pre-sampling procedures for groundwater purging and sampling are as follows:

1. Position a 5-gallon bucket beneath the well's sampling port.
2. Measure and record the depth to water in the production well.

Sampling Procedures

Sampling procedures for groundwater purging and sampling are as follows:

1. Purging- Begin purging the well by opening the sampling port and allowing water to fill the 5-gallon bucket. Purge a minimum of 10 gallons of water from the well.
2. Field Parameter Monitoring- After purging 10 gallons, measure the temperature, pH, conductivity in the purge water. Continue purging, collecting one set of measurements for each 5 gallons purged. Record measurements on the field purge log. The well is ready to be sampled once a minimum of 20 gallons of water has been purged from the well and the field parameters are stable over three consecutive readings. The following criteria identify stabilized field parameters:
 - ± 0.1 for pH
 - ± 3.0 percent for EC
3. Sample Collection- Fill all sample containers directly from the sample port. Allow water to flow from the port, tap gently down the inside of the containers to minimize turbulence during collection. Collect groundwater samples in order of importance, according to the project requirements.

APPENDIX C

Figures for SWQDAP

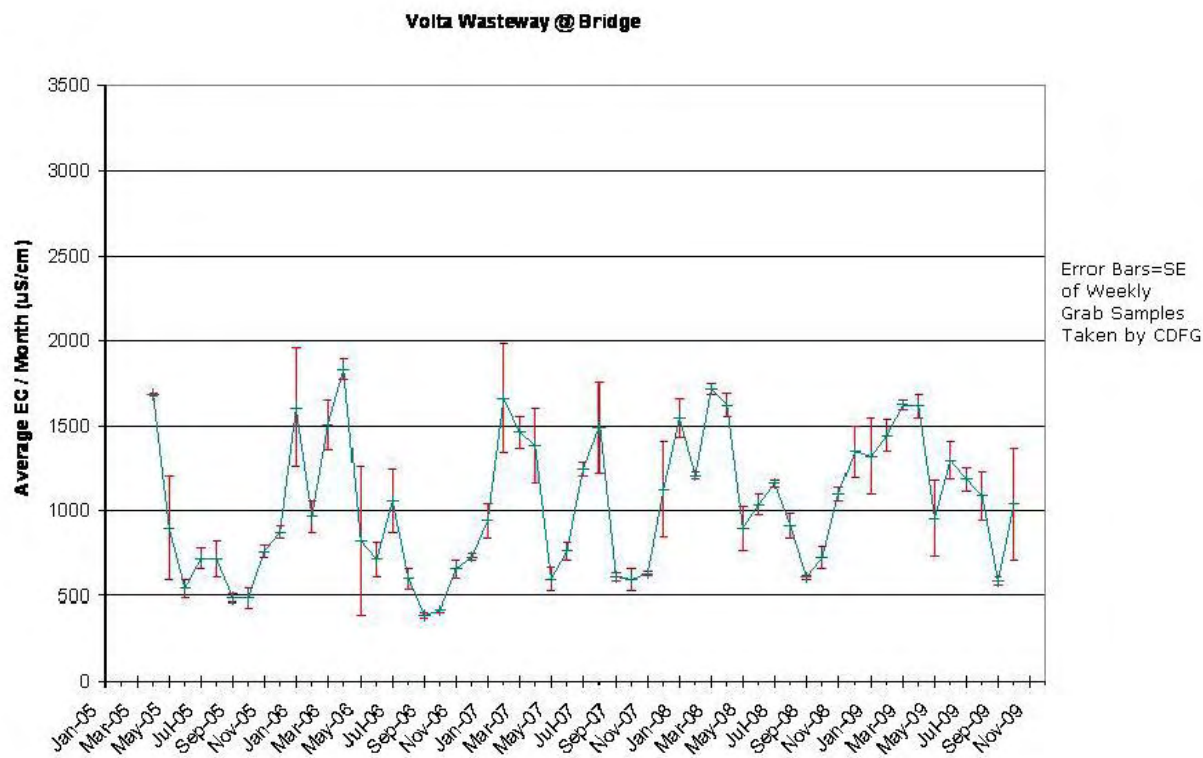


Figure 1.0 - Average EC/ Month + SE @ Wasteway Bridge

Volta Wildlife Area Level 2 Diversification/ Incremental Level 4 Development- Surface Water Quality Degradation Avoidance Protocol													
AVERAGE MONTHLY EC DATA FROM WEEKLY CDFG GRAB SAMPLE DATA COLLECTED FROM WASTEWAY, VOLTA WILDLIFE AREA 2005-2009													
Month	2005	SE	2006	SE	2007	SE	2008	SE	2009	SE	MAX EC 2005-2009	SE	MAX EC+ SE 2005- 2009
Jan	n/d	n/d	1607	349	942	100	1550	117	1321	224	1607	349	1956
Feb	n/d	n/d	966	96	1664	318	1409	202	1446	92	1664	318	1982
Mar	n/d	n/d	1510	148	1465	94	1721	33	1627	29	1721	33	1754
Apr	1690	9	1836	59	1387	223	1625	71	1620	71	1836	59	1895
May	897	308	824	436	597	66	897	130	744	86	897	223	1120
June	543	53	712	105	762	54	1038	61	1299	114	1299	114	1413
July	718	62	1059	186	1246	39	1161	19	1187	70	1246	39	1285
Aug	713	105	598	63	1492	268	912	74	1089	145	1492	268	1760
Sep	489	23	389	20	610	22	606	10	583	23	610	22	632
Oct	487	54	418	8	594	65	725	66	1038	330	1038	330	1368
Nov	760	39	658	53	629	13	1100	41	1250	189	1250	189	1439
Dec	875	40	728	23	1126	283	1350	150	1834	90	1834	90	1924
Monthly Avg Max EC Threshold = Max Monthly Avg EC + Max Standard Error observed from 2005-2009 = Pumping Ceases													
Pumping will CEASE at Production Wells if Monthly Avg Max EC Threshold is exceeded until Wasteway EC conditions improve													
Max Monthly Avg EC Observed from 2005-2009- Pumping Proceeds with Caution													
< Max Monthly Avg EC Observed from 2005-2009 - Pumping OK													
Month = Pilot Project Year 1 pumping duration - Giant Garter Snake Prey Avoidance Period; Goal 2,000 Acre ft													
EC Measure Downstream of Production Wells													
SE= STANDARD ERROR (Corresponding SE to Max Observed EC 2005-2009)													
nd= NO DATA													

FIGURE 2.0 - SWQDAP Table

Volta Wildlife Area Level 2 Diversification/ Incremental Level 4 Development- Surface Water Quality Degradation Avoidance Protocol
Actual EC- From CDFG Weekly Grab Sample Data 2005-2009
THRESHOLD- From Maximum Observed Monthly Average EC 2005-2009 + Standard Error 2005-2009

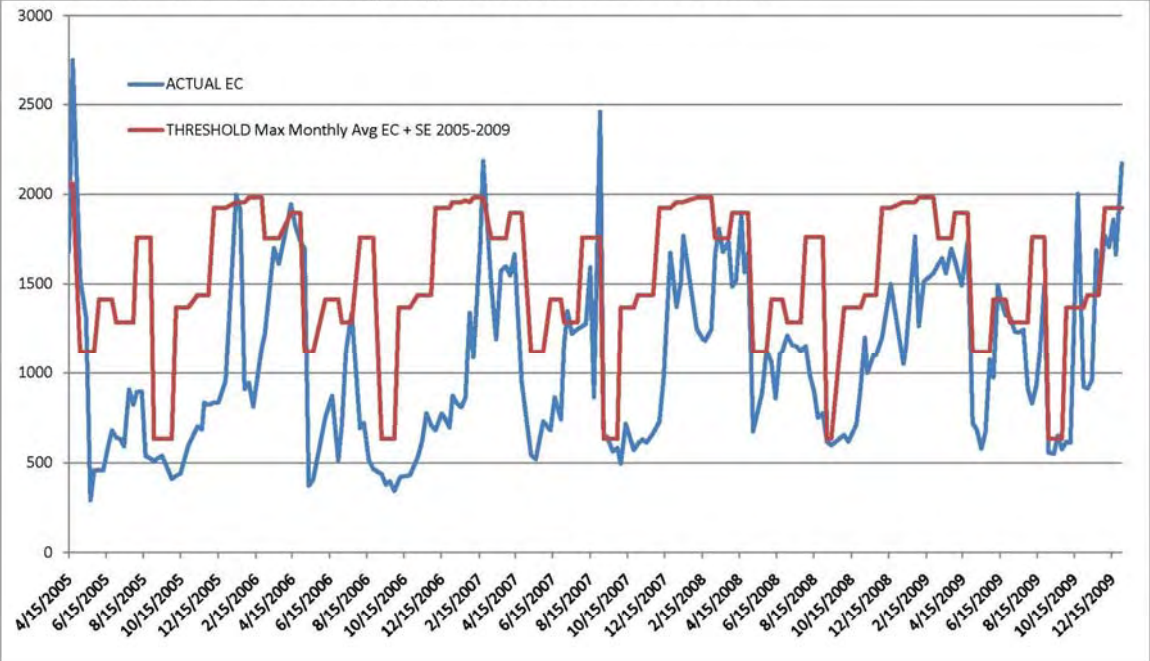


Figure 3.0 - Actual Vs. Threshold

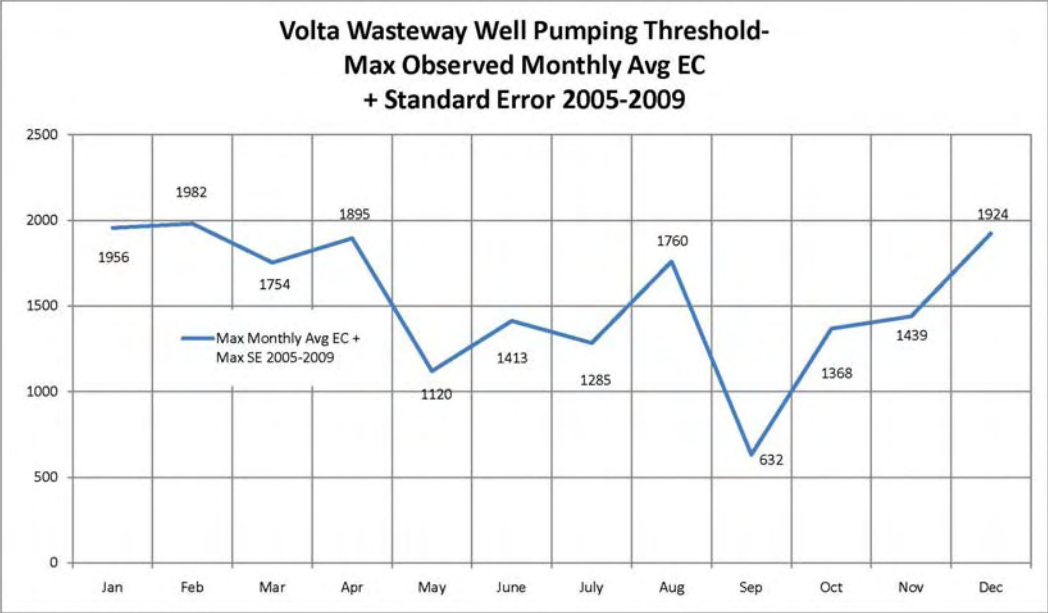
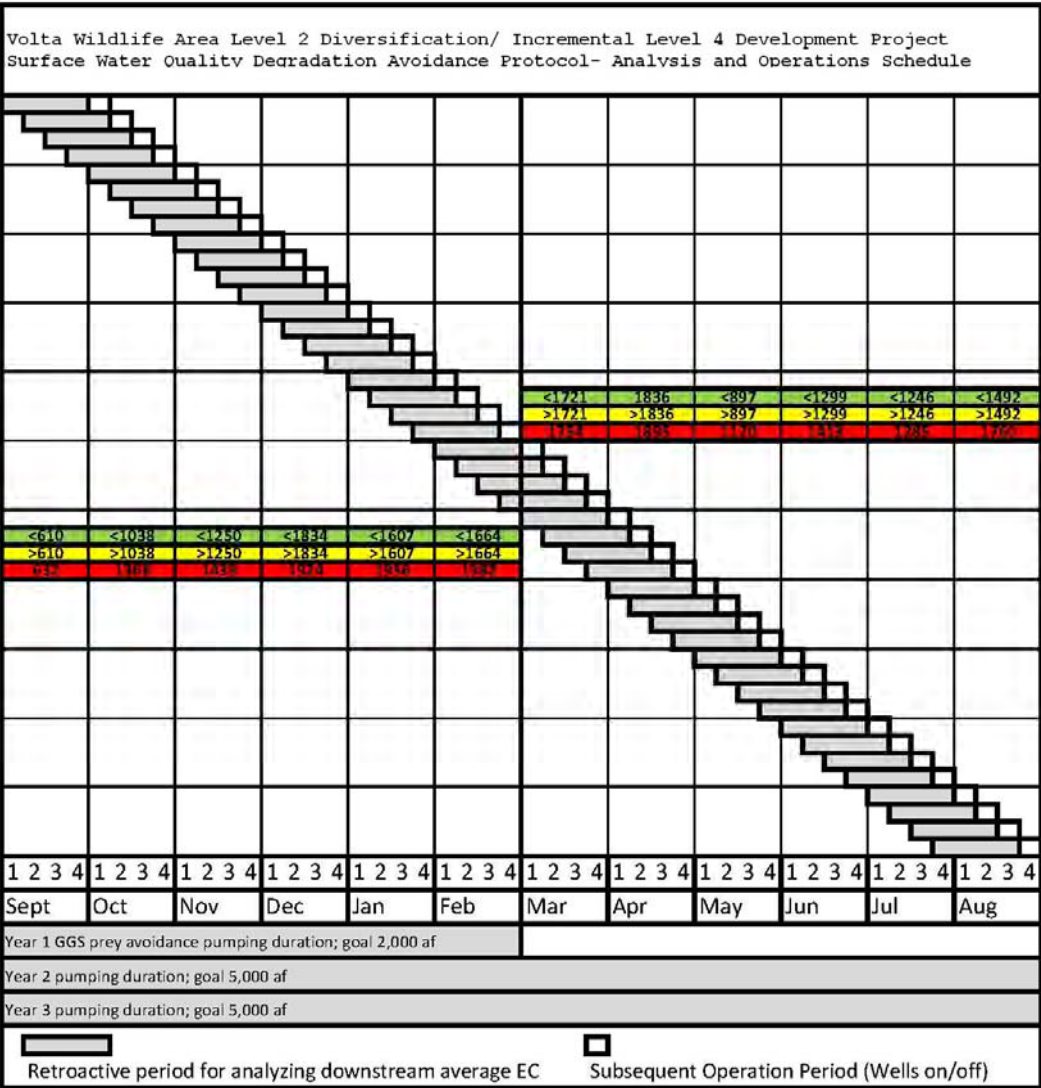


Figure 4.0 - SWQDAP Monthly Thresholds



Analysis will occur on a weekly basis to determine Well Operation for the week to come
Four Week Running Avg EC from weekly downstream samples compared to Monthly Average Max EC Threshold
Monthly Average Max EC Threshold derived from Volta Wasteway monthly Average EC & SE data from 2005-2009
See Attached Figure 2.0- Volta SWQDAP Table and Figure- 4.0 Monthly Threshold Graph

<Maximum observed monthly average EC 2005-2009- Pumping OK
>Max Monthly Avg EC Observed from 2005-2009- Pumping Proceeds with Caution
Monthly Avg Max EC Threshold = Max Monthly Avg EC + SE observed from 2005-2009 = Pumping Ceases
Pumping will CEASE if Monthly Avg Max EC Threshold is exceeded until Wasteway EC conditions improve

af = Acre Feet
EC = Electro-Conductivity
GGS = Giant Garter Snake *Thamnophis gigas*
SE= Standard Error

Figure 5.0- SWQDAP Analysis and Operation Schedule

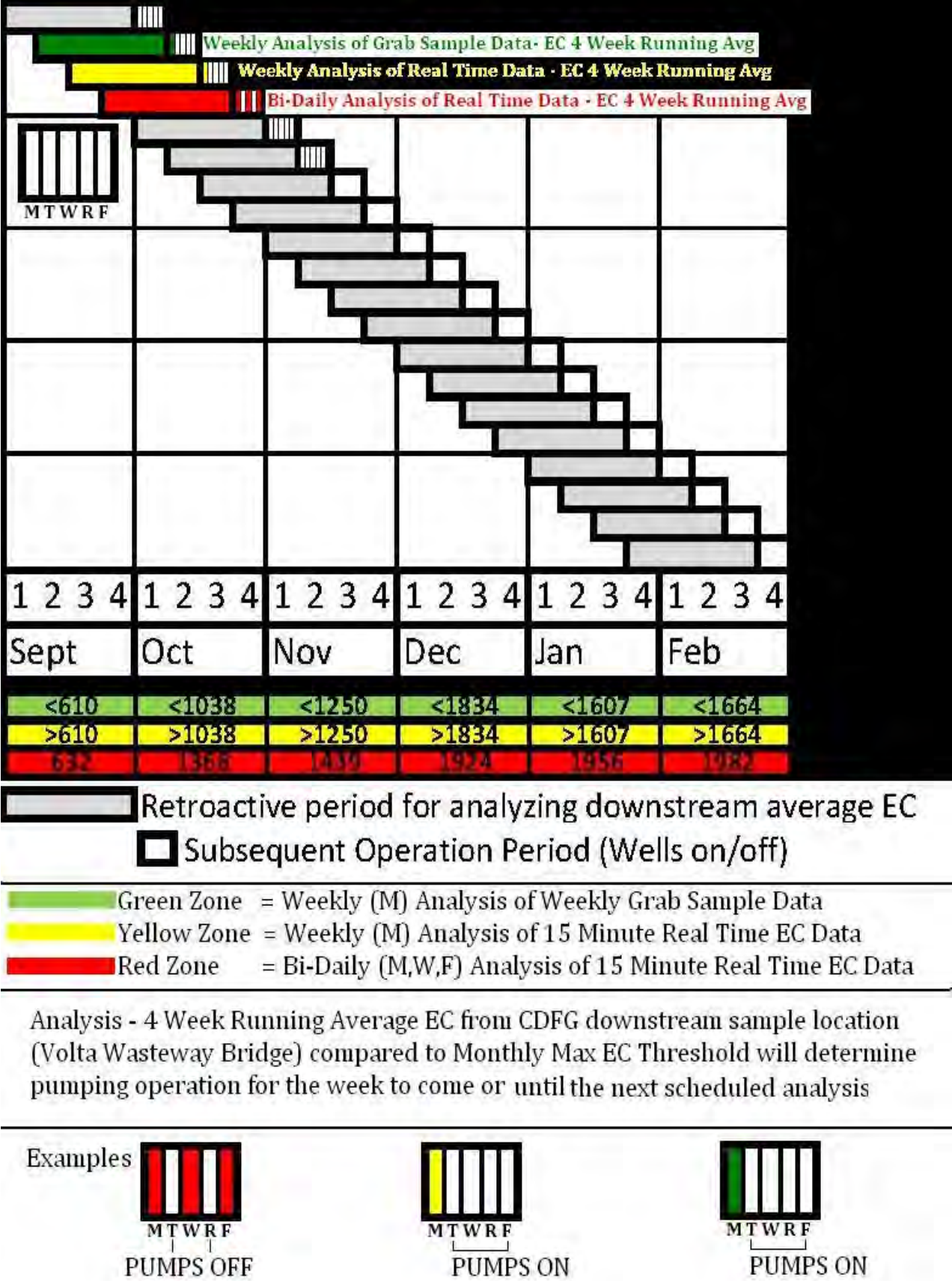


Figure 6.0- SWQDAP Conditional Real Time EC Data Analysis

Appendix D – Cultural Resource